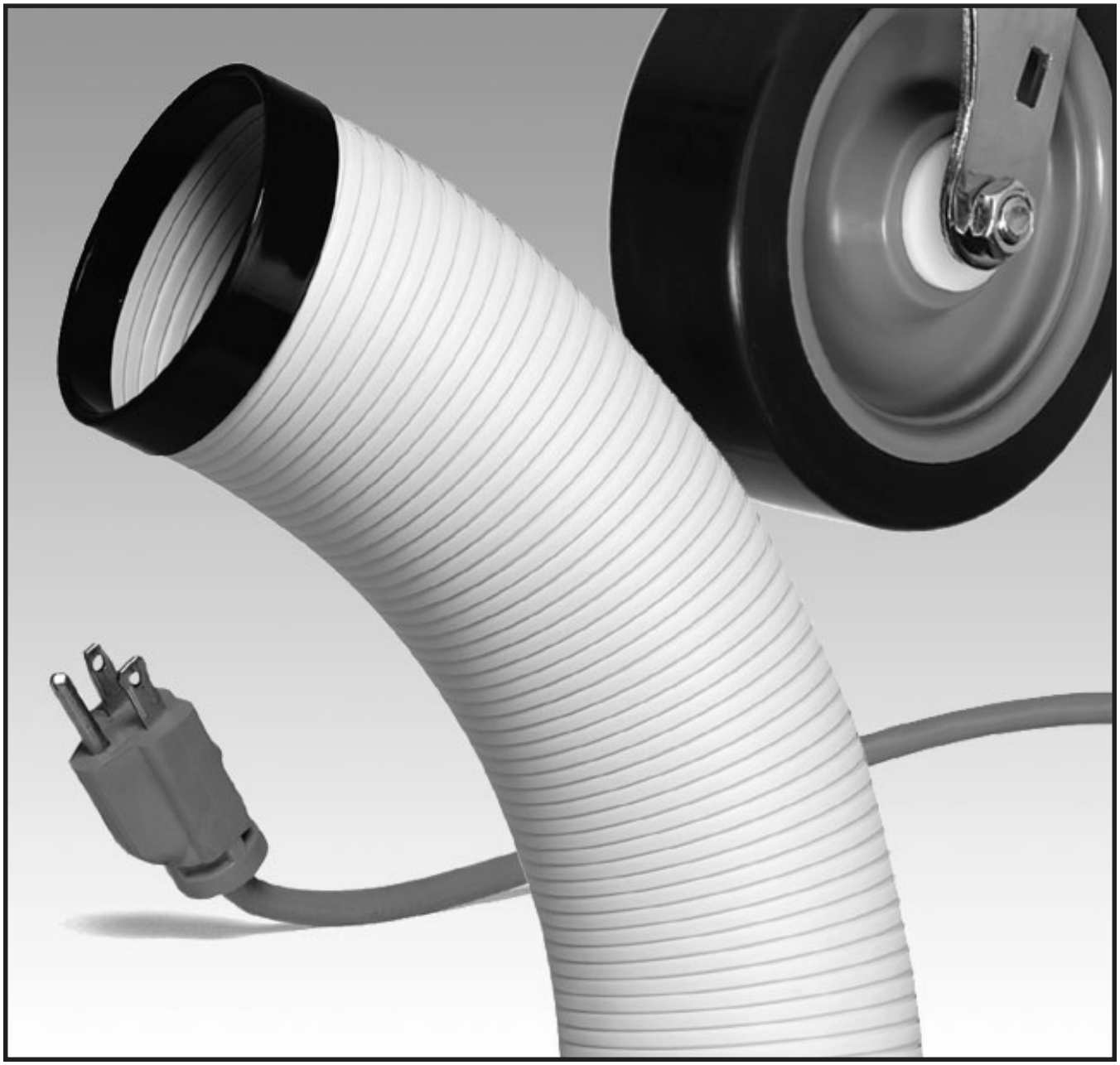
SERVICE **MANUAL**

OFFICE PRO 10



MOVINCOOL®

THE PORTABLE SPOT COOLING SOLUTION

SERVICE **MANUAL**

OFFICE PRO 10

MOVINCOOL®
THE PORTABLE SPOT COOLING SOLUTION

FOREWORD

This manual has been published to service the MovinCool Office Pro 10. Please use this service manual only when servicing the Office Pro 10.

DEFINITION OF TERMS

⚠WARNING: Describes precautions that should be observed in order to prevent injury to the user during installation or unit operation.

⚠CAUTION: Describes precautions that should be observed in order to prevent damage to the unit or its components, which may occur during installation or unit operation if sufficient care is not taken.

NOTE: Provides additional information that facilitates installation or unit operation.

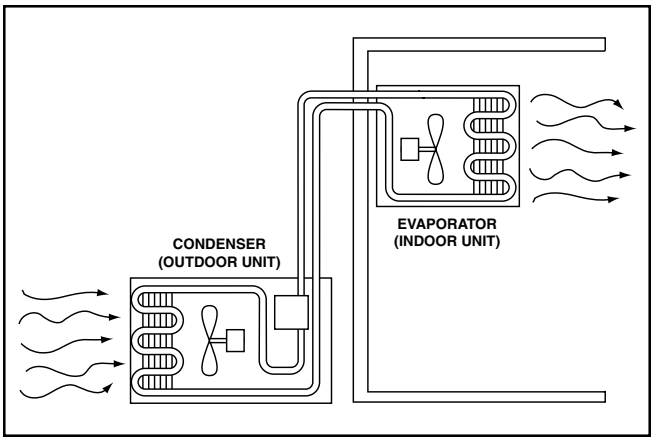
GENERAL PRECAUTIONS

⚠WARNINGS:

- **All electrical work if necessary, should only be performed by qualified electrical personnel. Repair to electrical components by non-certified technicians may result in personal injury and/or damage to the unit. All electrical components replaced must be genuine MovinCool, purchased from an authorized reseller.**
- **When handling refrigerant, always wear proper eye protection and do not allow the refrigerant to come in contact with your skin.**
- **Do not expose refrigerant to an open flame.**
- **The proper electrical outlet for MovinCool units must be equipped with a "UL" approved ground-fault breaker to prevent electrical shock from the unit.**
- **When brazing any tubing, always wear eye protection and work only in a well ventilated area.**
- **Disconnect power before servicing unit.**
- **Be careful of any sharp edges when working on unit.**

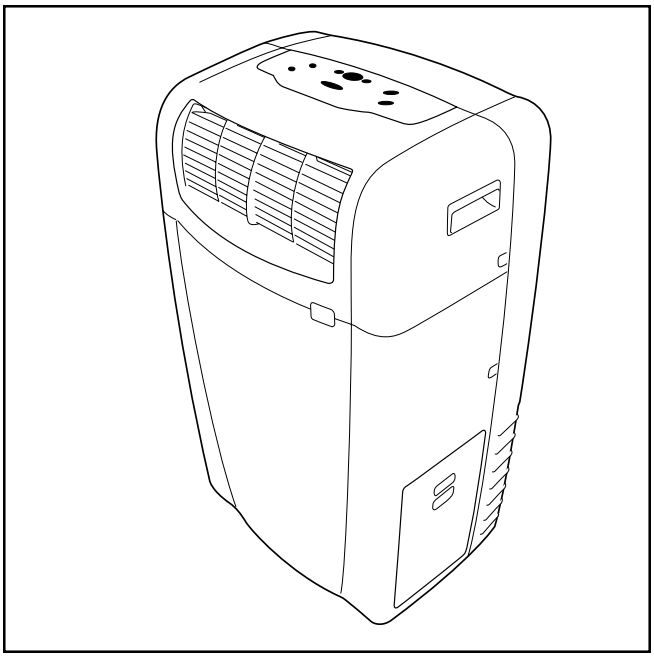
TABLE OF CONTENTS

GENERAL DESCRIPTION



Conventional Air Conditioner

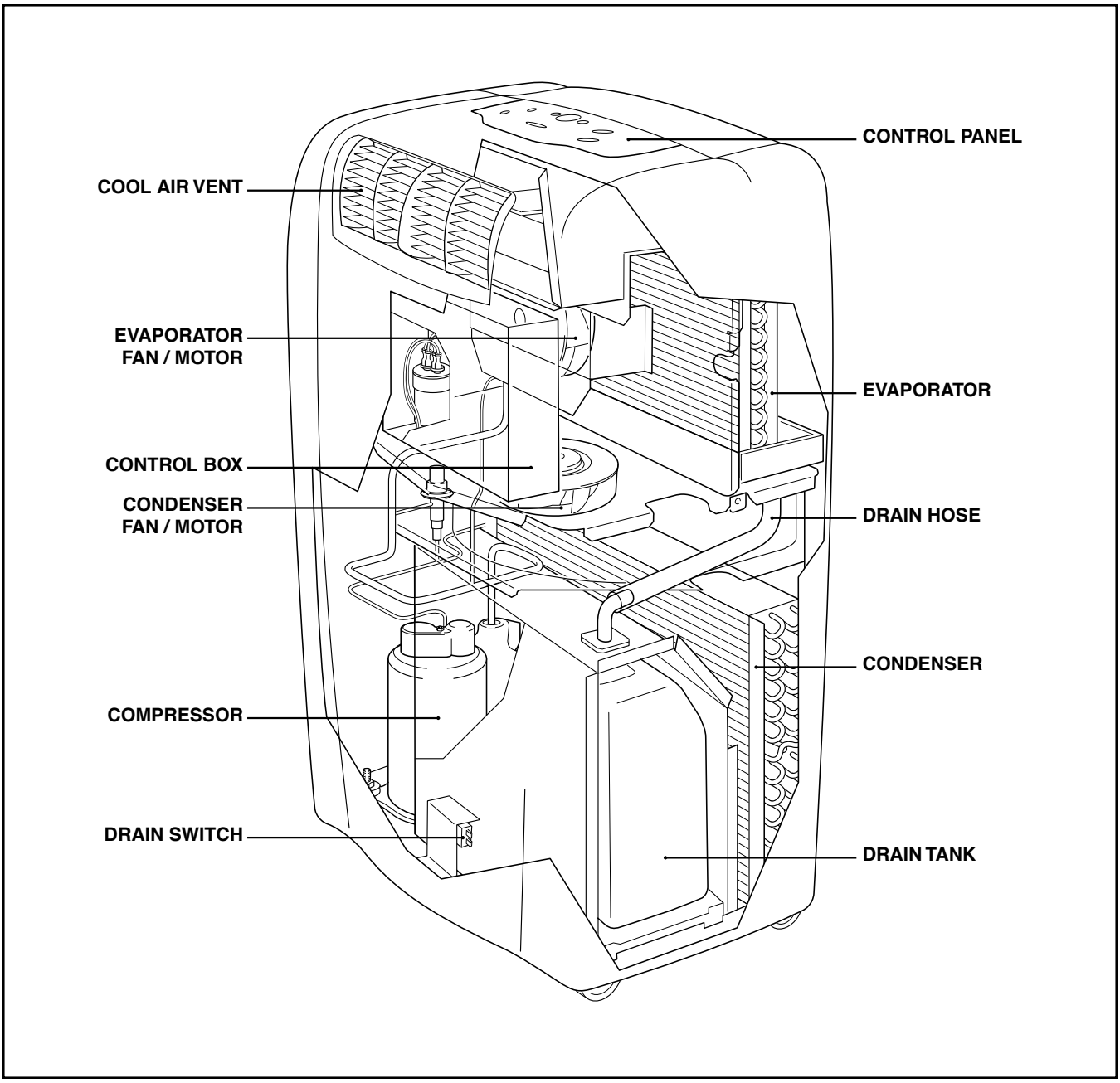
Generally speaking, conventional air conditioners cool the entire enclosed environment. They act as “heat exchangers”, requiring an interior unit (evaporator) to blow cool air into the interior and an exterior unit (condenser) to exhaust exchanged heat to the outdoors. Unlike conventional air conditioners, the MovinCool Spot Cooling System is a spot cooler which directs cool air to particular areas or objects. MovinCool Spot Cooling Systems have the following features:



Office Pro 10

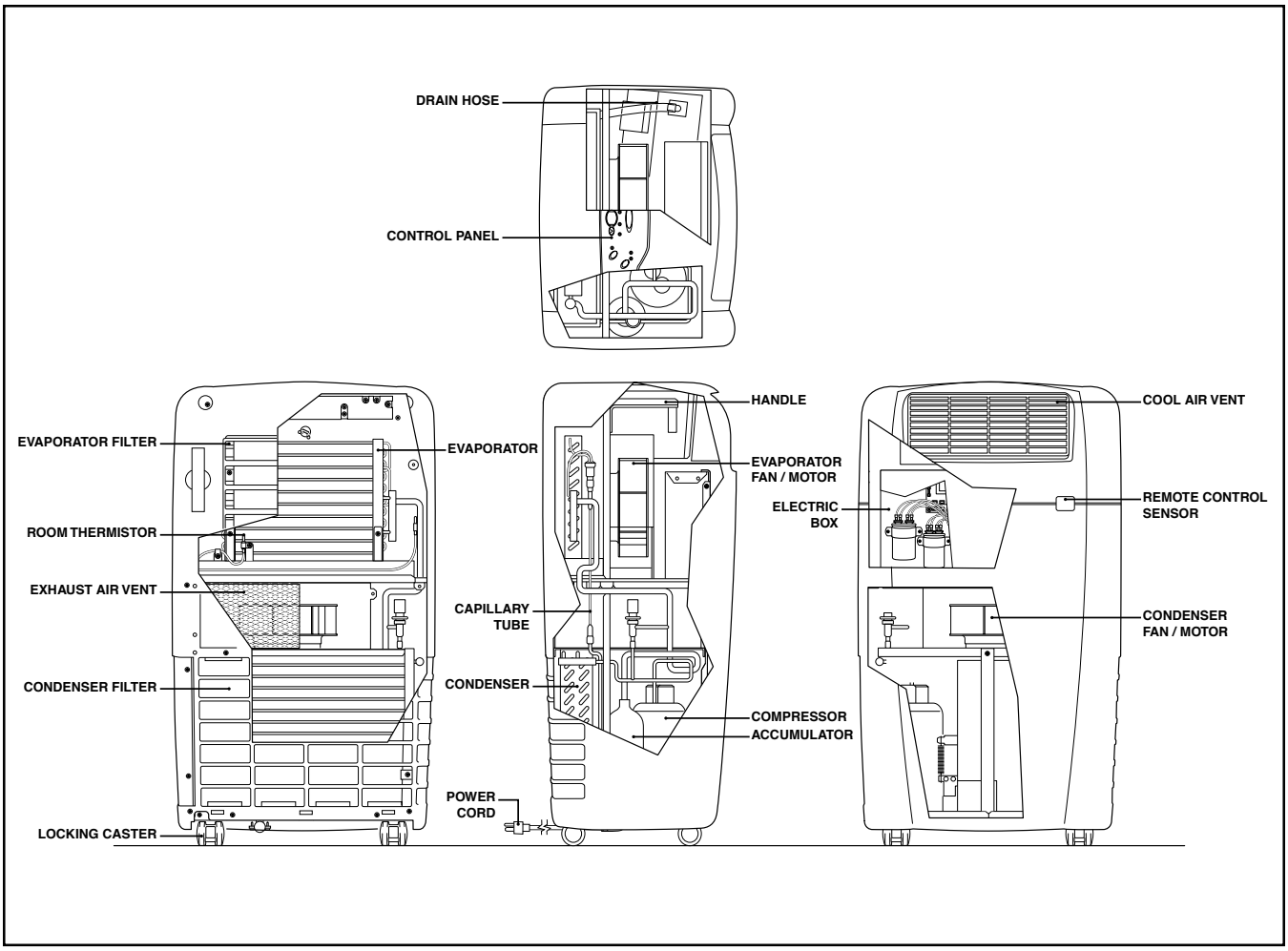
1. **Compact Design**
   The innovative design of MovinCool has resulted in one compact unit, replacing the need for two separate units.
2. **Easy Transportation and Installation**
   With the whole cooling system built into one compact unit, MovinCool requires no piping and can be easily transported and installed.
3. **Energy Conservation**
   MovinCool is economical because it cools only the area or objects which need to be cooled.

GENERAL DESCRIPTION



Construction of Office Pro 10

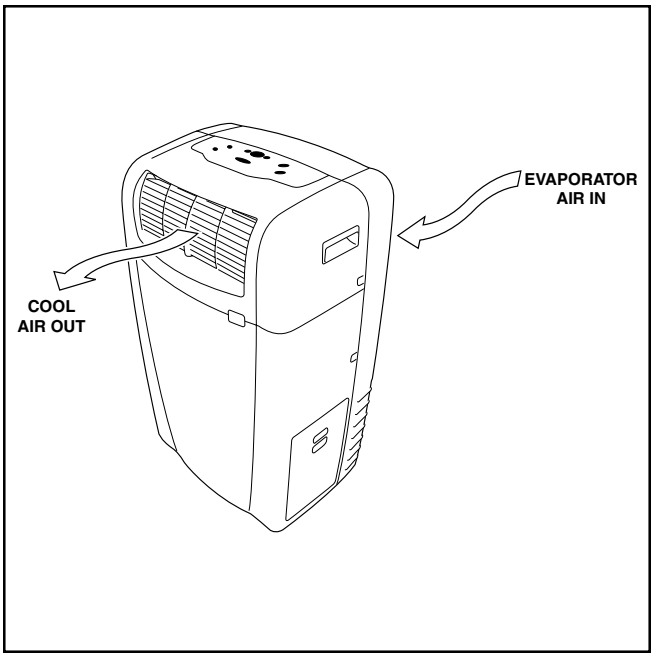
CONSTRUCTION, SPECIFICATIONS, and DATA



Construction Diagram

1. Basic Construction

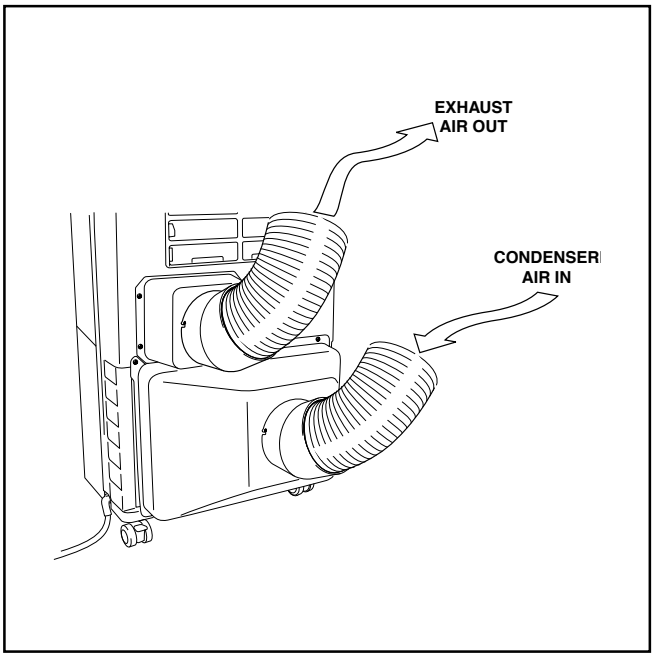
The MovinCool Spot Cooling System is compact in construction because the condenser and the evaporator are enclosed in one unit. The interior is divided into three sections. The upper back section is equipped with the evaporator and drain tank. The rear section contains the condenser. The compressor and the control box are both at the front of the unit.



Air Flow

2. Air Flow

Air is drawn from the intake ducts then passes through the condenser which extracts the heat. This hot air is blown out through the exhaust air duct. Air taken in from the rear face is cooled by the evaporator and then blown through the cool air vent. All the air inlets are equipped with filters, while the exhaust air outlet is protected by wire mesh.



Condenser / Exhaust Air Flow

3. Compressor and Fans

The compressor is hermetically sealed. A two-speed fan motor is used with centrifugal (backward impeller) fans to draw air across the evaporator. The condenser fan draws air over the condenser section.

4. Drain Tank

The capacity of the drain tank is approximately 3.0 gallons (11 liters). The unit is equipped with a “Tank Full” LED and a device to automatically stop the operation of the unit when the drain tank reaches a level of approximately 3.0 gallons (11 liters).

5. Condensate Pump (Optional)

The condensate pump will pump water from the pump’s main tank to a nearby sink or floor drain. The pump will lift the water a vertical distance of 18 feet. A plastic hose is supplied with the pump. It is important that the drain line from the pump is not kinked or bent.

CONSTRUCTION, SPECIFICATIONS, and DATA

Rating Conditions

dry bulb	95˚ F (35˚ C)
wet bulb	83˚ F (28.2˚ C)
humidity	(60%)

Specifications

power frequency	60Hz
line voltage	single phase 115V
power consumption	1.25 Kw
current consumption	11.5 Amps
power factor	95%
starting current	40A
power wiring	14 (3-core) AWG

Cooling Unit

cooling capability	2,440 Kcal/hr 9,700 BTU/hr
cooling system	direct expansion

Blower

type of fan:	Evaporator	centrifugal fan (backward impeller)
	Condenser	centrifugal fan (backward impeller)
air volume:	Evaporator (High speed)	205 CFM (344m^3/h)
	Evaporator (Lo speed)	175 CFM (294m^3/h)
	Condenser (High speed)	370 CFM (622m^3/h)
motor output:	Condenser (High)	0.08 Kw
	Evaporator (High)	0.08 Kw
	Evaporator (Low)	0.05 Kw

Compressor

type	Rotary
output	0.68 Kw
refrigerant type	R-22
refrigerant capacity	1.61 lbs (0.71 kg)

Safety Devices

compressor overload protector	included
anti-freezing thermistor	included
full drain tank switch	included
automatic restart (power interruption)	included
compressor time delay program	included

Dimensions & Weight

W x D x H (in)	22" x 14" x 38"
W x D x H (mm)	559 x 356 x 965
weight (lbs/kg)	130 / 59

Operating Conditions

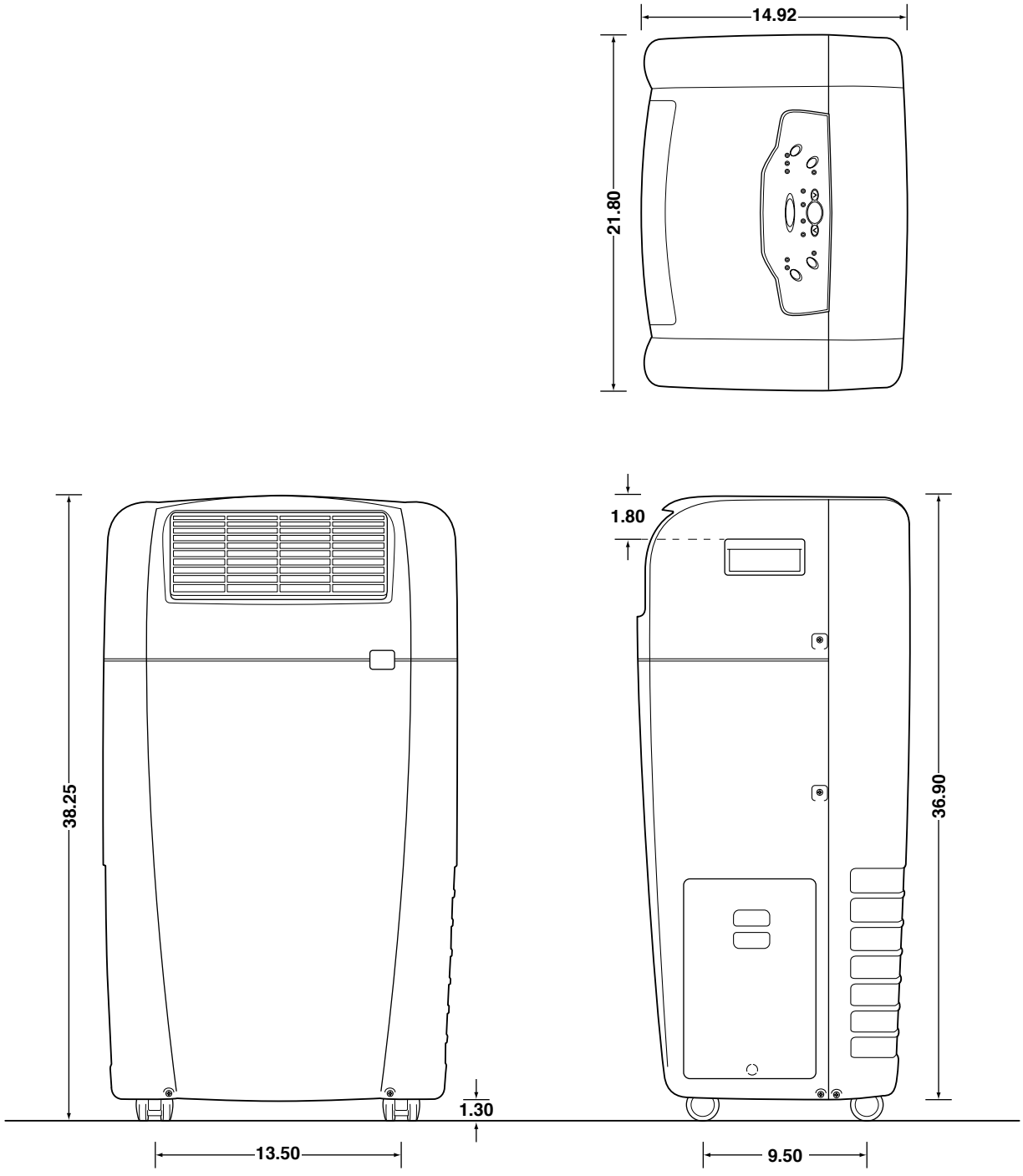
inlet air (relative humidity)	95˚ F (35˚ C), (50%) 65˚ F (18.3˚ C), (60%)

Control Devices

temperature control	included
programmable timer	included
two speed fan	included

Specifications

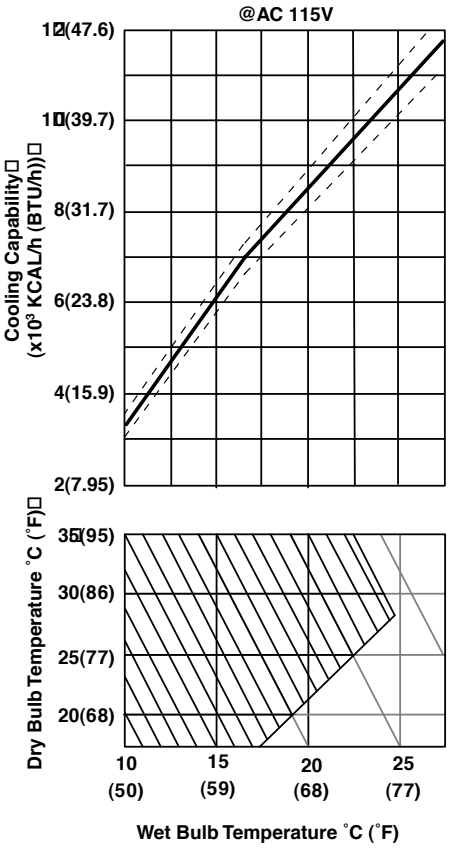
Specifications are subject to change without notice.



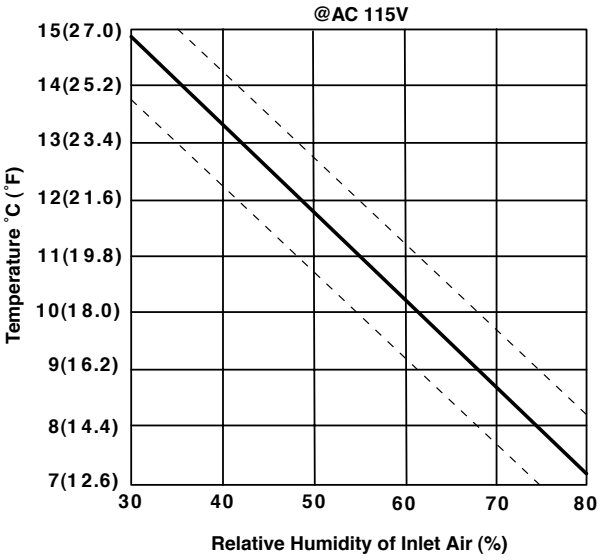
Exterior Dimensions (units: inches)

DATA

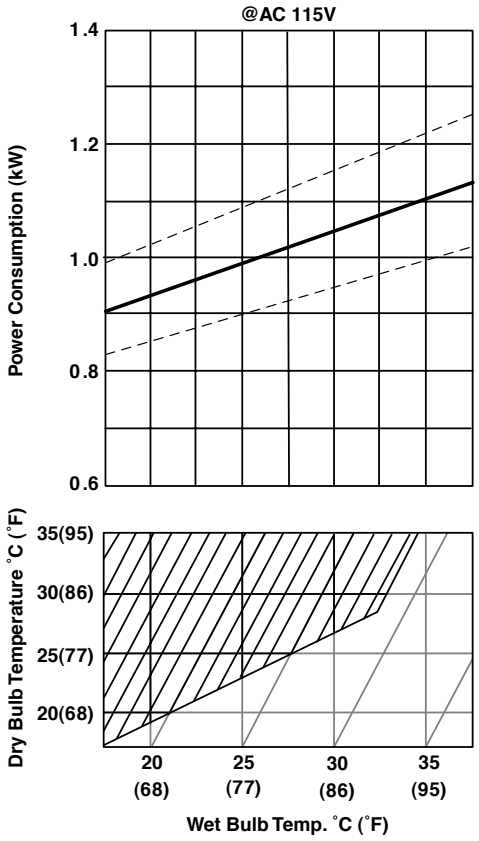
Cooling Capability Curve



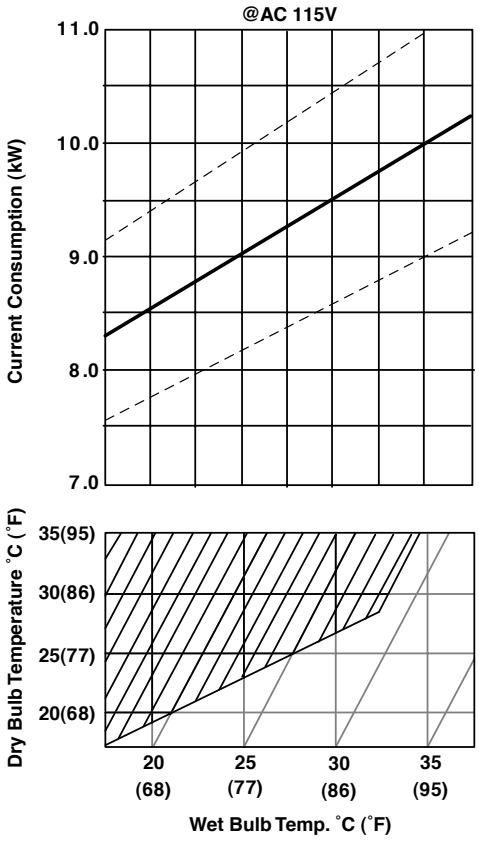
Cool Air Temperature Difference Curve



Power Consumption Curve



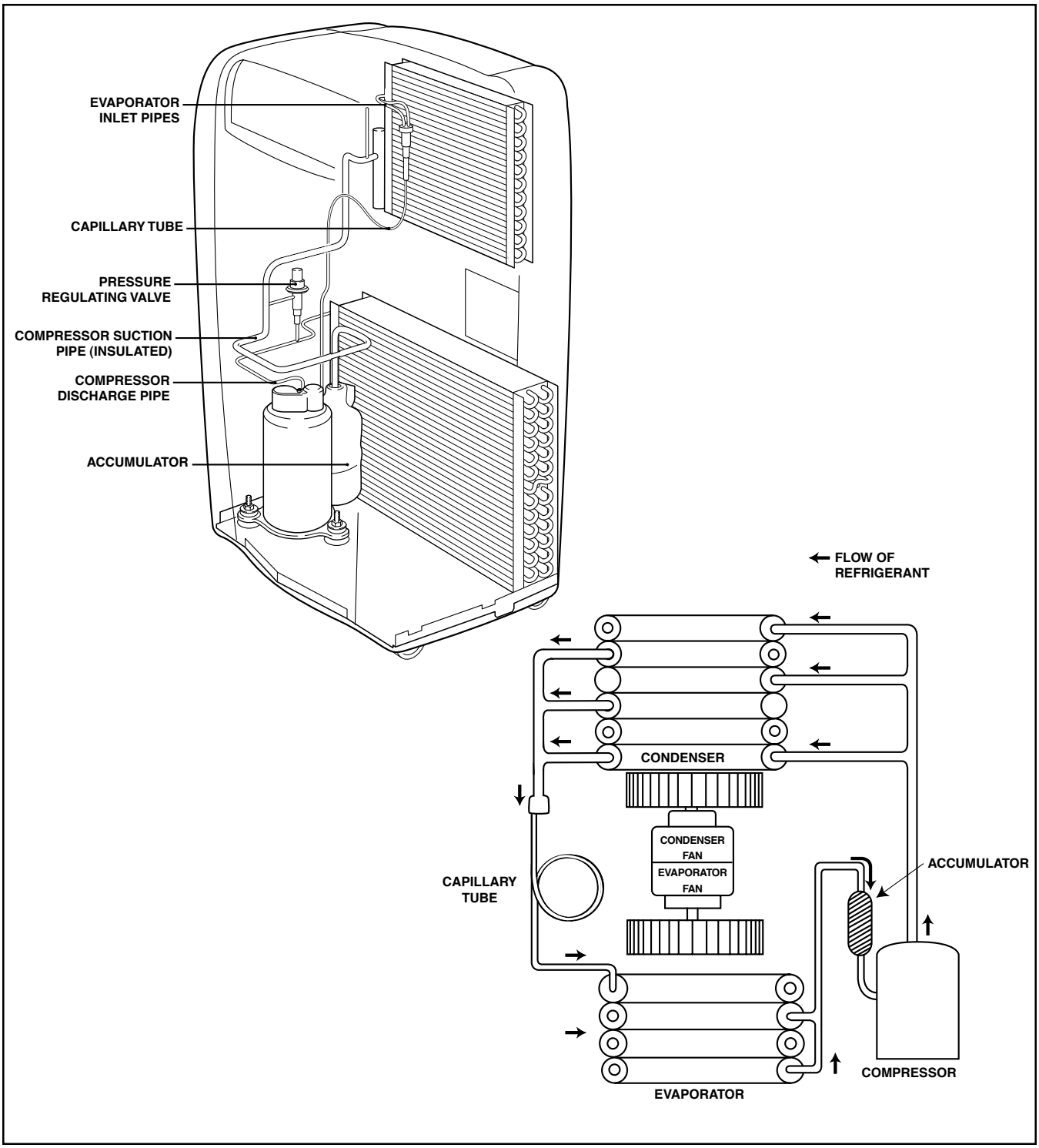
Current Consumption Curve



1. The component parts of the refrigerant system include the following:

- Compressor
- Condenser
- Capillary tube
- Evaporator
- Accumulator

These parts are all connected by copper tubing. All the connections have been brazed.



Refrigerant System

REFRIGERANT SYSTEM

1. Compressor

The compressor used for the unit is hermetically sealed. The compressor and the compressor motor are in one casing.

A. Compressor Construction

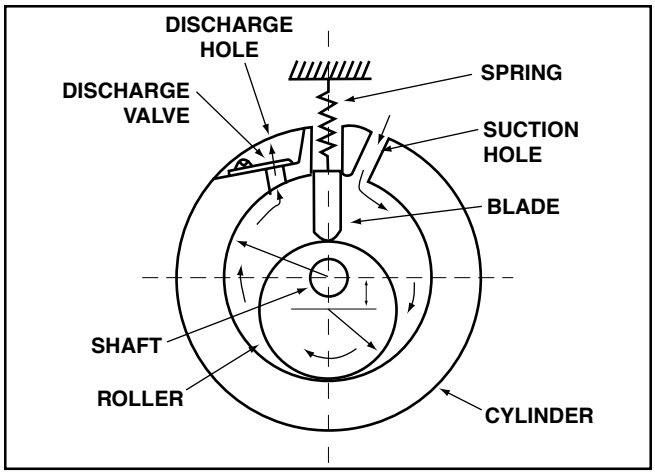
The construction of a rotary type compressor is divided into two mechanisms. The drive mechanism (compressor motor) and the compression mechanism (compressor). When the rotor shaft of the motor (drive mechanism) turns, the roller of the compressor (compression mechanism) rotates to compress the refrigerant.

B. Basic Compressor Operation

The roller (compression mechanism) is set eccentrically with a certain distance given from the axis of the center of the cylinder. A spring loaded blade is mounted on the cylinder. The roller turns to compress the refrigerant in the space between the cylinder and eccentrically mounted roller.

The blade is in contact with the roller by means of spring force. It partitions the space between the suction side and the discharge side to keep compressed refrigerant from returning to the suction side.

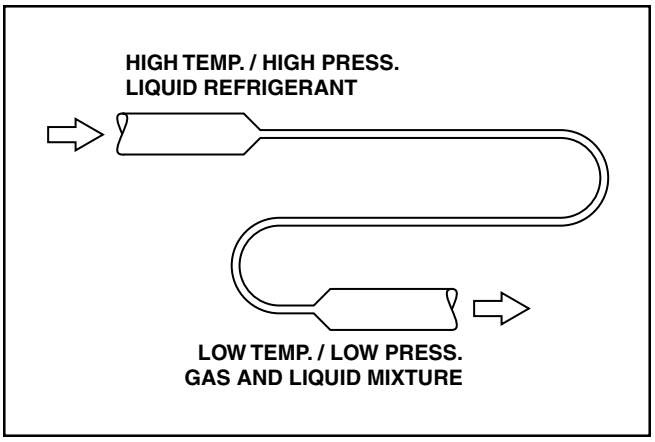
There is no suction valve. The discharge valve is designed not to open until the pressure of the refrigerant within the cylinder reaches or exceeds that of the refrigerant on the discharge side. This design prevents the backward flow of discharge gas.



Compressor Operation

2. Condenser

The condenser is a heat exchanger with copper tubes that are covered with thin aluminum plate fins. Heat is given off and absorbed by air being pulled across the condenser fins by the centrifugal fan and then expelled through the exhaust air duct.



Capillary Tube

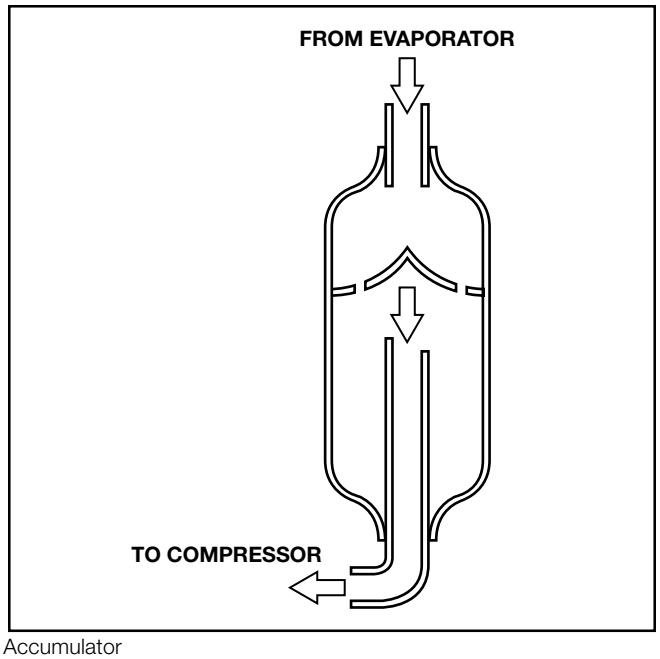
3. Capillary Tube

The capillary tubes are long thin tubes utilizing line flow resistance to serve as an expansion valve. The length and the inner diameter of the capillary tubes are determined by the capacity of the refrigeration system, specified operating conditions, and the amount of refrigerant.

The capillary tubes cause the high pressure, high temperature liquid refrigerant sent from the condenser to expand rapidly as the refrigerant is sprayed out through the fixed orifice in the capillary tubes. As a result, the temperature and state of the refrigerant become low and mist-like respecitively, causing it to evaporate easily.

4. Evaporator

The evaporator, like the condenser, is a heat exchanger utilizing plate fins. Heat is removed from the air being pulled across the evaporator by the centrifugal fan and the resulting cool air is expelled through the cool air vent.

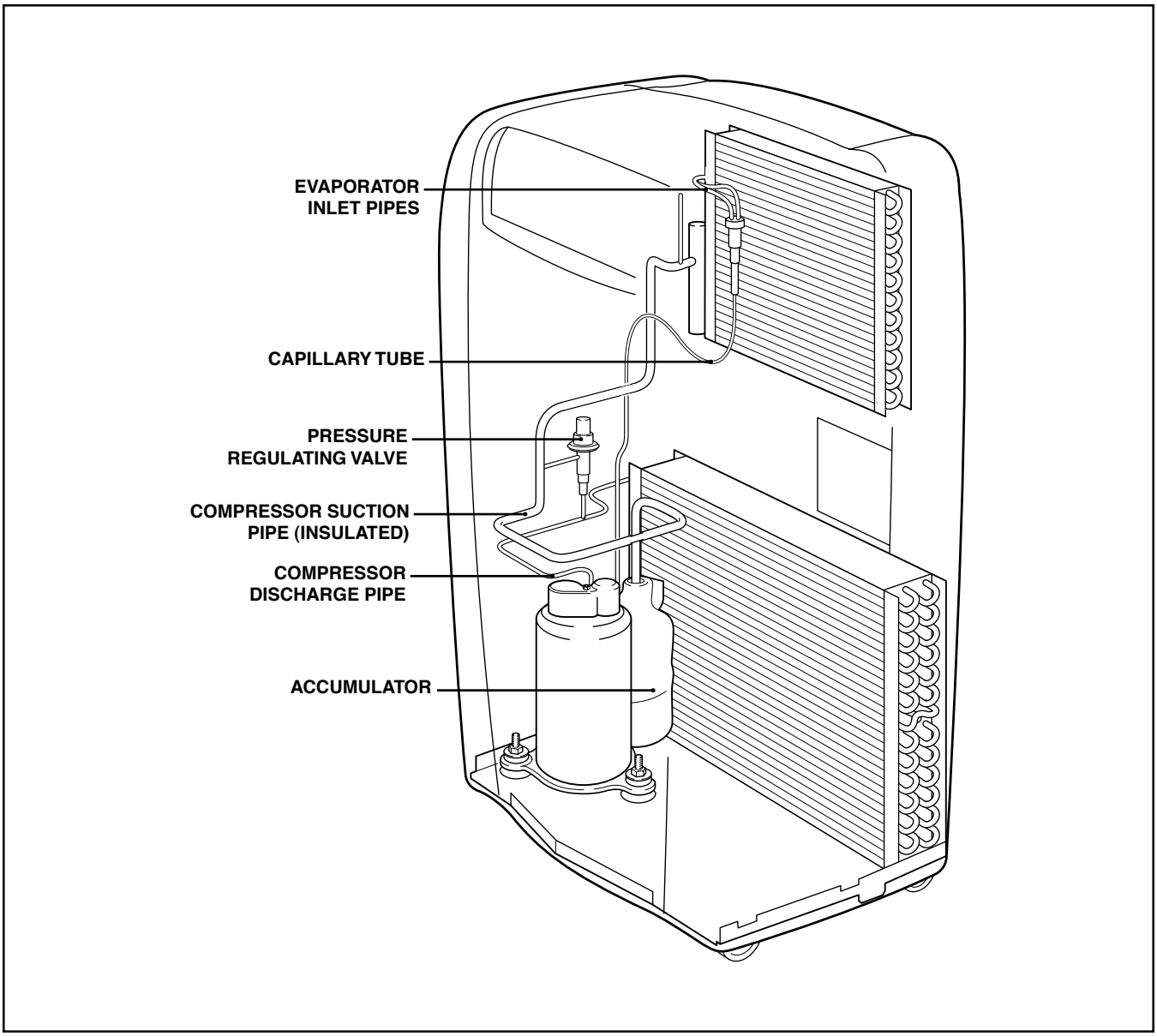


Accumulator

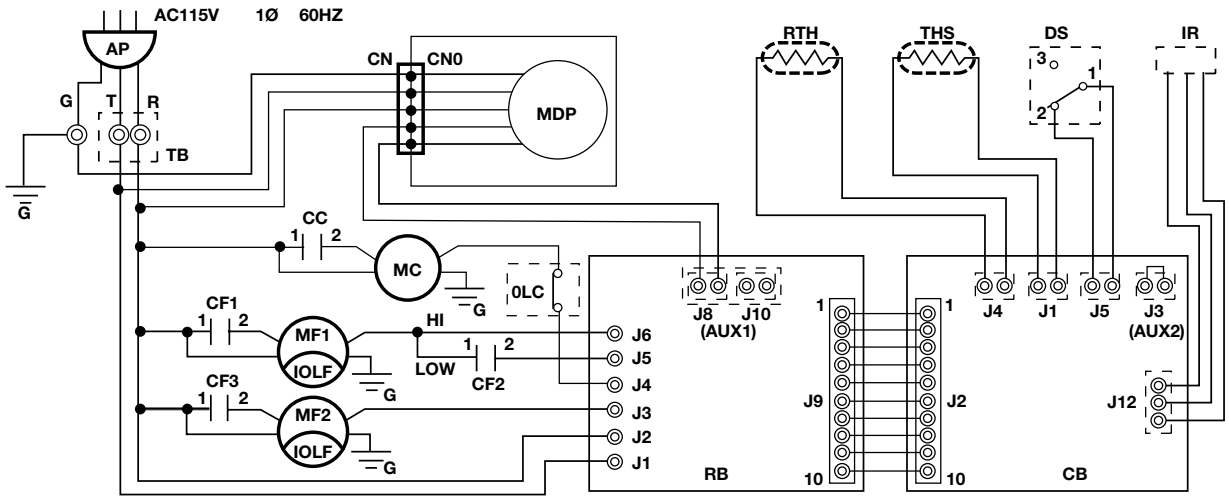
5. Accumulator

The accumulator is mounted on the suction gas piping between the evaporator and the compressor. The accumulator separates the liquid refrigerant from the gas refrigerant letting only the gas refrigerant enter the compressor. In the accumulator, suction gas is led into a vessel having a cylindrical body, and the gas speed is decreased inside the vessel. This separates the refrigerant contained in the gas by the force of gravity causing it to accumulate at the bottom of the vessel. This protects the compressor from possible damage caused by the intake of liquid refrigerant.

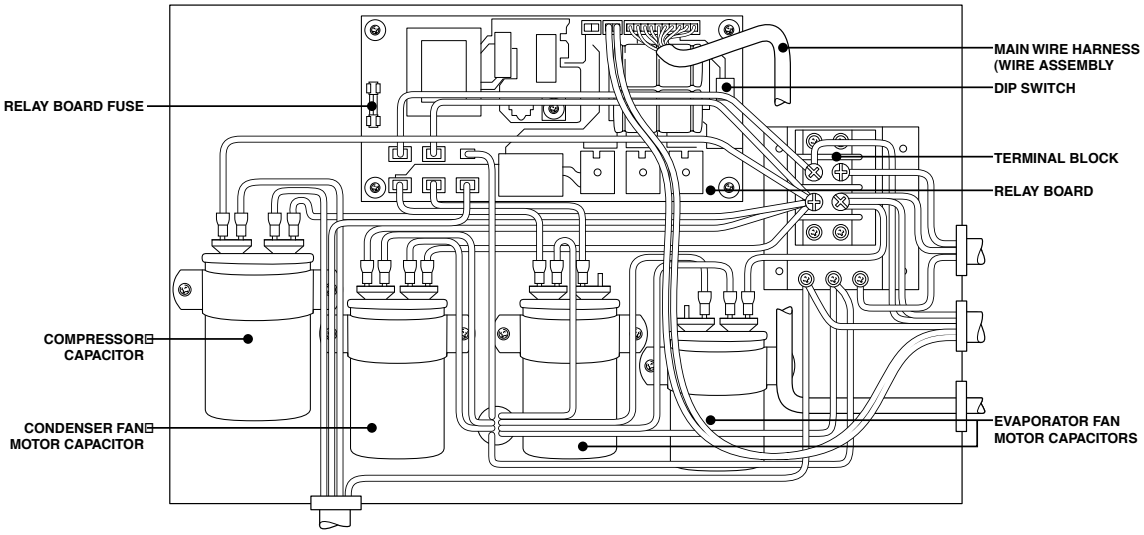
REFRIGERANT SYSTEM



Refrigerant System Piping



AP	Attachment Plug	OLC	Overload Relay of Compressor
TB	Terminal Block	DS	Full Drain Warning Switch
CB	Control Board	THS	Freeze Protection Thermistor
RB	Relay Board	RTH	Room Thermistor
MF1	Fan Motor of Evaporator	IR	Remote Receiver Board
MF2	Fan Motor of Condenser	G	Ground
MC	Compressor Motor	CN	Connector for Drain Pump (Unit Side)
CF1	Capacitor for Fan Motor of MF1	CNO	Connector of Drain Pump (Pump Side)
CF2	Capacitor for Fan Motor of MF1	MDP	Drain Pump
CF3	Capacitor for Fan Motor of MF2		
CC	Capacitor for Compressor	AUX1	Auxiliary Connector
IOLF	Internal Overload Relay of Fan Motor	AUX2	Auxillary Connector / Jumper



Electrical System and Control Box

ELECTRICAL SYSTEM

1. Basic Operation of Office Pro 10 Electrical Circuit

There are two basic components used to control the operation of the Office Pro 10 Electrical System:

- Control Panel Assembly
- Control Box

The Control Panel Assembly contains the Control Panel, Control Board (with inputs for the freeze and room temperature thermistors), drain switch, and a microprocessor.

A. Fan "Only" Mode (Evaporator)

Low Fan Mode - When the "Low" Fan Mode button on the control panel is pressed, the microprocessor turns on the button's LED and activates the Fan "On" Relay (Relay Board), sending line voltage (115 VAC) to the N.C. (Normally Closed) contacts of the fan "mode" relay. This output is connected to the J5 terminal (relay board) where the LOW SPEED wire of the fan motor is connected.

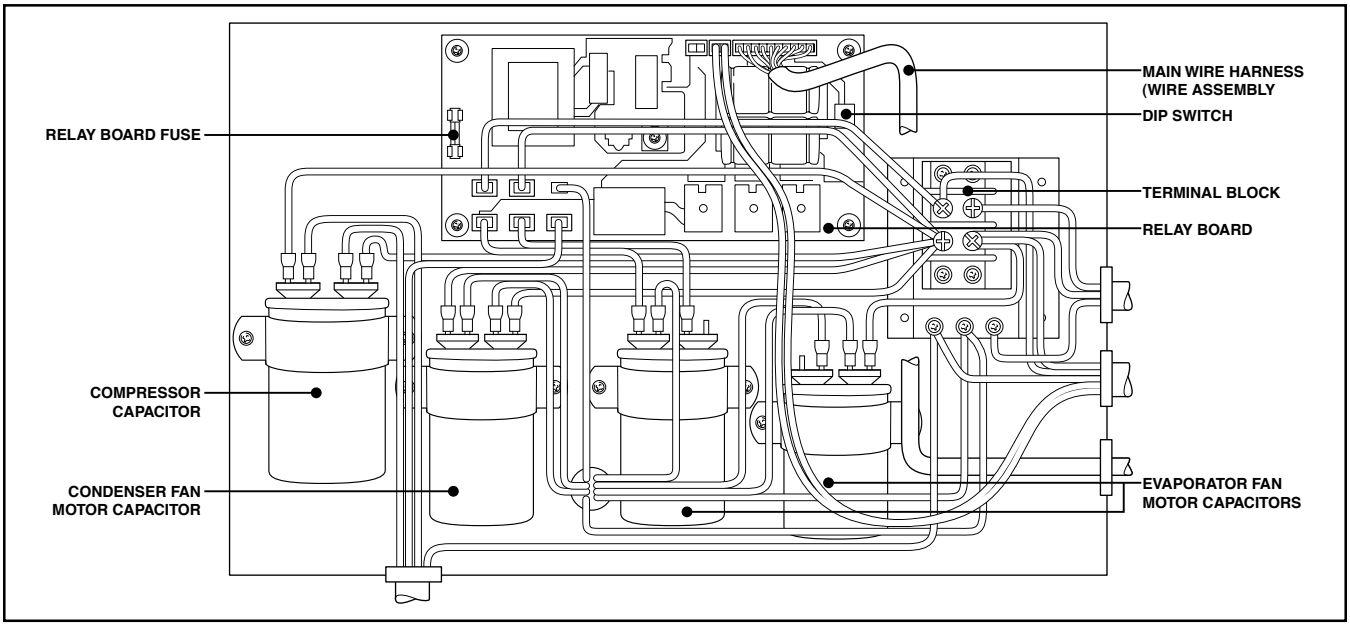
Note: Low fan mode does not operate in Fan "Only" mode.

High Fan Mode – When the "High" Fan Mode button on the control panel is pressed, the microprocessor turns on the button's LED and activates both the Fan "On" Relay and Fan "Mode" Relay. This sends line voltage (115 VAC) from the Fan "On" Relay to the N.O. (Normally Open) contacts of the Fan "Mode" Relay. This output is connected to the J6 terminal (relay board) where the HIGH SPEED wire of the Fan Motor is connected.

B. Cool Mode - In Addition to Fan "Only" Mode (as described above)

When the Cool On/Off button on the control panel is pressed, the microprocessor turns on the button's LED and if the Temperature Set Point is less than the current room temperature, this activates the Compressor Relay (Relay Board) after a hundred and twenty (120) second delay. This sends line voltage (115 VAC) to the J4 terminal (Relay Board) where the wire from the Compressor wire harness is connected.

2. Control Box

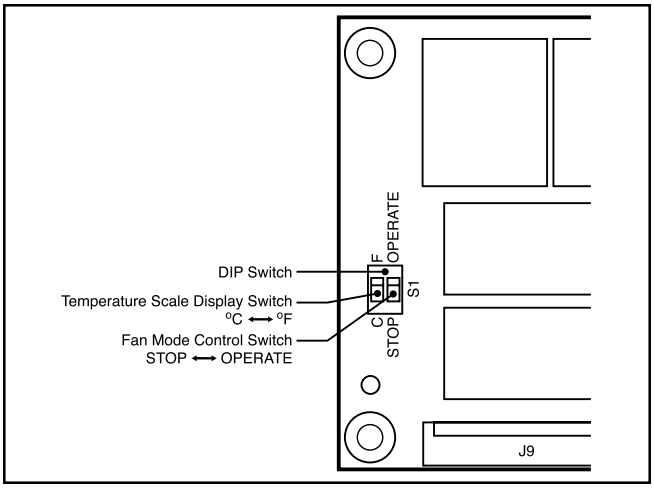


Control Box

CAPACITOR APPLICATION	VOLTAGE RATING	CAPACITANCE (μf)
Evaporator Fan Motor	370	3
Evaporator Fan Motor	370	20
Compressor	370	40
Condenser Fan Motor	370	15

A. Capacitors

The capacitors are used to temporarily boost the power output available to the fan motor and the compressor at start-up. The specifications of each capacitor are listed on the left.



DIP Switch

B. Relay Board

The relay board receives signals and outputs from the control board that contains a microprocessor. The relay board contains the compressor, fan on and fan mode (speed) relays. It also contains a step-down transformer that converts the line voltage (115 VAC) to 12 volts. This is then converted from AC to DC and used for relay coil activation. The 12V (DC) power is sent to the Control Panel Assembly where it is further regulated to 5 volts for the system logic.

The relay board also contains the DIP-Switch. The DIP-Switch is used to change the Fan Mode operation from Stop to Operate and change the temperature display from ˚F to ˚C.

NOTE: The relay board must be serviced as a complete assembly. It has only <u>one</u> serviceable component, the fuse.

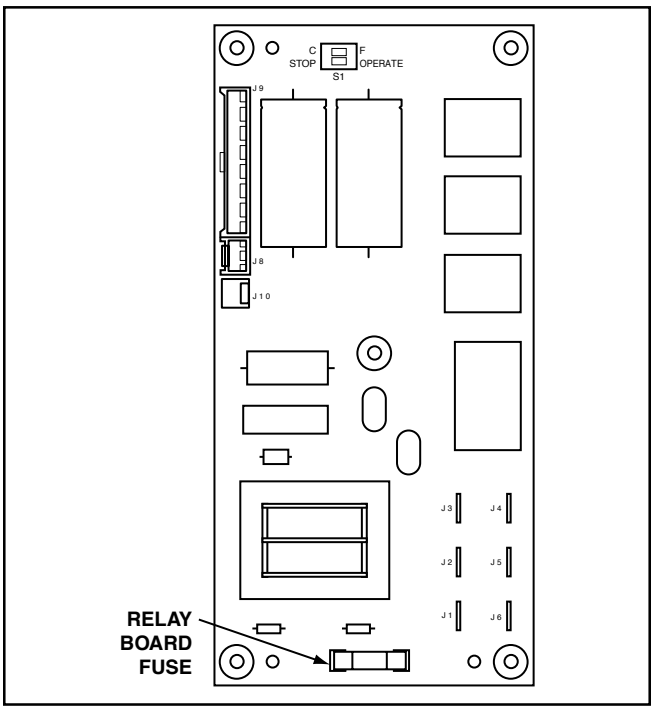
(a) Relay Board Fuse

NOTE: The relay board fuse is the <u>only</u> serviceable component on the relay board assembly.

This fuse provides protection against damage to the step-down transformer. It must be replaced with the exact type of fuse or an equivalent.

Fuse Specifications: 160mA / 250V

⚠CAUTION: Failure to use the exact type of fuse could result in damage to the unit and/or to components. It will also void the warranty of the unit.



Relay Board

ELECTRICAL SYSTEM

3. Motorized Impeller (Evaporator)
The fan motor is a single phase, centrifulgal type.

Specifications: Rated Voltage: 115 Volts 60 Hz
Rated Power: 85 watts

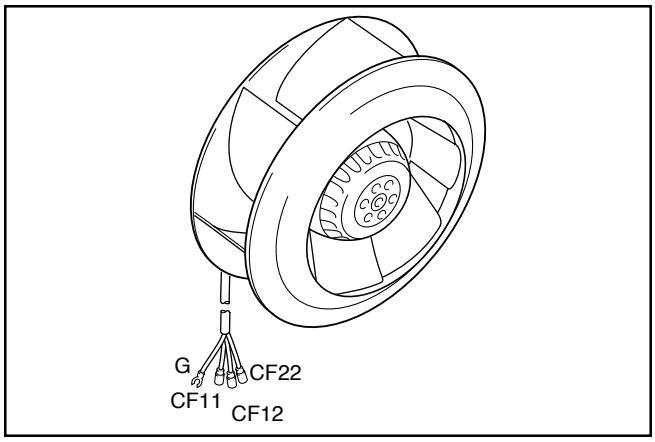
4. Motorized Impeller (Condenser)
The condenser fan motor is a single phase induction type.

Specifications: Rated Voltage: 115 Volts 60Hz
Rated Power: 215 watts

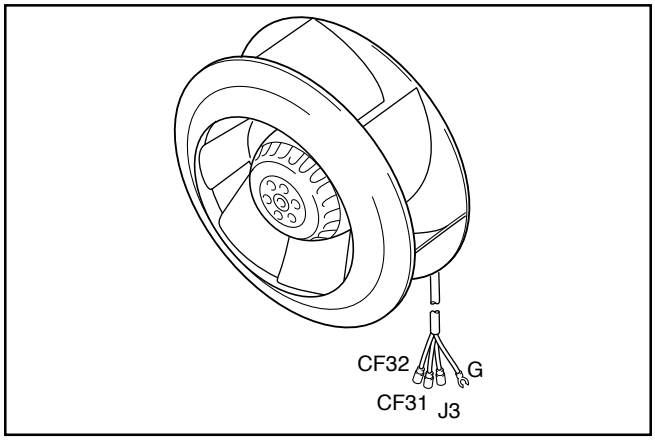
5. Compressor Motor
The compressor motor is a single phase motor. It is contained within the same housing as the compressor.

Specifications: Rated Voltage: 115 volts
Rated Power: 1100 Watts

NOTE: An internal overload relay is used to protect the compressor motor. This relay is built into the compressor motor and will interrupt the flow of current when there is an overcurrent situation or if abnormally high temperature builds up in the compressor motor.

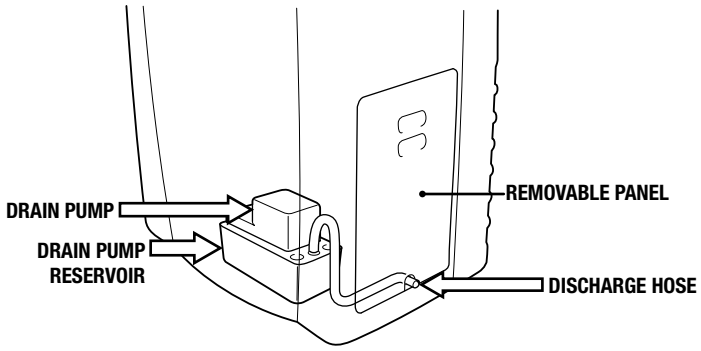


Evaporator Fan Motor

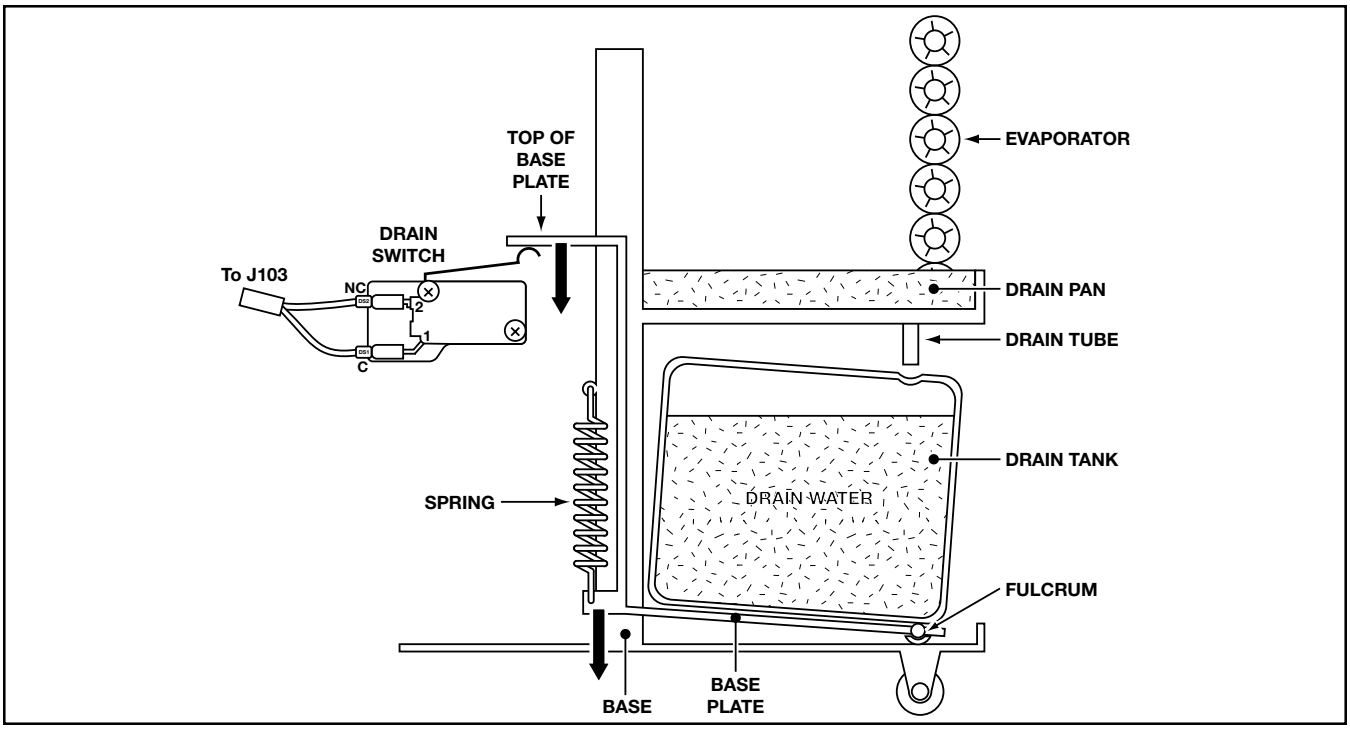


Condenser Fan Motor

6. Condensate Pump
The Office Pro 10 model has an optional condensate pump, which collects the water that forms on the evaporator during normal cooling operation and eliminates the need for a drain tank.



Condensate Pump



Operation of Drain Switch

7. Drain Switch

The Office Pro 10 is equipped with a drain tank switch. When the drain tank accumulates approximately 3.0 gallons (11.4 liters) of condensate (water) in the drain tank, the drain tank switch sends a signal to the microprocessor. The microprocessor stops all operation of the unit and flashes the “Tank Full” LED.

This system utilizes a 0.1 AMP, 115 VAC micro-switch for this function. When drain water accumulates approximately 3.0 gallons (11.4 liters) in the drain tank, the drain tank base plate, which is supported at its fulcrum, is pushed down in the arrow direction as shown in the figure below. When the drain tank base plate is forced down, the top of the drain tank base plate turns off the contacts (1) – (2) of the micro switch.

This causes the ground signal at the J5 connector of the control panel assembly to close. When the microprocessor detects this event, it shuts the unit off and flashes the “Tank Full” LED.

When the drain tank is removed (or the drain tank is emptied), the top of the drain tank base plate returns to its original position from the tension of the coil spring. Then contacts (1) – (2) of the drain tank switch open. This provides a ground to the microprocessor through the J5 connector.

8. How to Switch to Manual Mode

If the program **Run** LED is flashing, press the **Set** and **Run** buttons to switch to manual mode. If the program **Run** LED is illuminated continuously (program activated), no further steps are necessary.

9. Automatic Restart after Power Interruption

The program within the microprocessor of the Office Pro 10 contains a feature that will automatically restart the unit after power is lost and then regained. The unit also has memory in order to return itself back to the operating mode (either Manual or Preset Program) it was in prior to the loss of power. Any “Preset” Program will also be retained in the memory in the event power loss occurs.

ELECTRICAL SYSTEM

10. Compressor Protection

There is a Time Delay program within the microprocessor. This prevents a heavy load from being applied on the Compressor Motor when restarting the unit (Cool Mode) after a very short period of time. This "delay" is in effect any time when the compressor is turned on by either the "Cool On/Off" button, temperature set point (thermostatic control), power interruption restart or Condensate Pump operation.

Time Delay Program Specifications: 120 ± 10 sec.

11. Temperature Control

The compressor operation (Cool Mode) is controlled by the microprocessor which receives input signals from the room temperature thermistor (evaporator inlet air) and the setting of the Temperature Set Point. The Temperature Set Point (desired room temperature) can be adjusted by pressing the ▲ / ▼ buttons on the Control Panel. The adjustment range of the Temperature Set point is 65˚F (LO) to 89˚F (HI) (18˚C to 32˚C).

12. Fan Mode Control Switch

The fan motor operation is controlled by relays on the relay board through a microprocessor in the control panel assembly. The fan program in the microprocessor can be changed by a DIP-Switch on the upper right side of the Relay Board located in the Control Box. There are two settings:

A. Cool to Stop

When the DIP-Switch is set to the left or "Stop" position, the microprocessor controls the fan motor using the same room temperature thermistor that it uses to control the compressor. In this case, both the fan and the compressor stop when the microprocessor receives a sufficiently low intake air (room temperature) signal from the thermistor (equal to or less than the set point). When the temperature increases (exceeds the set point) the microprocessor will restart the fans and the compressor automatically. However, if the unit has been off for less than 120 sec., the evaporator fan will start at the same time as the compressor (time delay program).

B. Cool to Operate

When the DIP-Switch is set in the right or "Operate" position, the microprocessor controls the fan operation using control panel inputs only. The fan will operate continuously during Fan Only and Cool Modes. (This is the "Factory Default" setting.)

13. Temperature Scale Display Switch

When the DIP Switch is set in the left or ˚C position, the Set Point and Room Temperature will be displayed in degrees Celcius (˚C). The LED that indicates ˚C will also be illuminated.

When the DIP Switch is set in the right or ˚F position, the Set Point and Room Temperature will be displayed in degrees Farenheit (˚F). The LED that indicates ˚F will also be illuminated (this is the "factory default" setting).

14. Compressor Overload Relay

An external compressor overload relay is used to protect the compressor motor. This relay is mounted within the connector housing that attaches to the top of the compressor. The relay will interrupt the flow of current when there is an overload caused by a high temperature condition in the compressor.

Specifications:

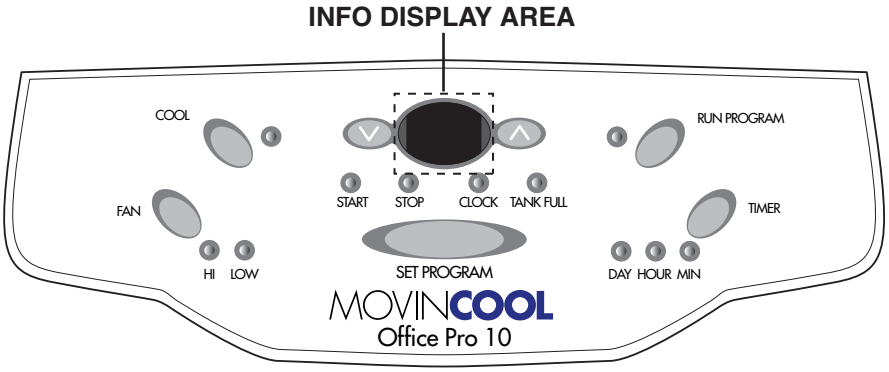
	Temperature	Variance	Short Trip (seconds)
Contacts Open	302˚F / 150˚C	± 9˚F / ± 5˚C	11 ± 5 sec. @ 25˚C
Contacts Closed	142˚F / 61˚C	± 20˚F / ± 11˚C	

Before troubleshooting the system, the following inspection should be performed.

1. **Inspection of Power Source Voltage**
   Check the voltage of the power source.
   Single phase 115 volts (60Hz)
   Check the operation and condition of the fuse or circuit breaker in the power source.

2. **Inspection of Air Filters**
   Remove the air filters and check the element. If the element is dirty, wash it as described in the OPERATION MANUAL supplied with the unit.

3. **Inspection of Drain Tank**
   Be sure tank is fully drained.
   The following chart is provided as a guide for categorized problem remedies. Detailed information is contained in the OPERATION MANUAL supplied with the unit.



4. **Self-Diagnostic Codes**
   Self-Diagnostic codes will be displayed on the control board under the following conditions:

   DF When the evaporator antifreeze thermistor disengages the compressor.

   TF When the drain tank switch shuts off the unit (full tank LED flashes).

   AS Unit disengages the compressor when the water level safety switch has activated.

TROUBLESHOOTING AND REPAIR

5. Troubleshooting Chart

Trouble	Probable Cause
Unit does not operate at all	• Check for Power at Receptacle • Fan mode DIP switch is set to “Stop” and current Set Point Temperature exceeds Room Temperature • Fan mode DIP switch is set to “Stop” and unit has Condensate Pump that is defective • Check for Power at Terminal Block • Check for Power at Relay Board • Check all wire connections • Defective Drain Tank Switch • Check Relay Board Fuse • Defective or Incorrect Relay Board • Defective Control Board
Unit starts, but stops immediately	• Room temperature and antifreeze thermistor connectors are reversed on control board • Defective Fan Motor • Defective Compressor Motor • Defective Relay Board
Unit operates, but stops after a few minutes	• Drain Tank Switch activated • Fan Mode Switch is set to “Stop” and unit reached “set point” temperature so compressor cycled off • Defective Compressor Motor • Defective Fan Motor • Fan Mode Switch is set to “Stop” and compressor cycled off
Water leakage from the unit	• Condensate pump not working • Drain Tank not installed • Drain Tank (if available) is defective (cracked) • Drain Pan hole is obstructed • Drain hose kinked
Abnormal noise and/or shaking	• Loose Compressor mounting nut • Deformed or worn rubber grommet on the compressor mounting bolt • Internal interference with other components • Damaged or out of balance fan

Trouble	Probable Cause
Unit is not responding to control board / buttons. No diagnostic code is shown.	• Unit is in the programming mode and locked out. Press the RUN and SET buttons simultaneously.
Insufficient Air Flow	• Clogged fins on Evaporator or Condenser (running unit without filter(s)) • Fan on “Low” setting • Defective fan motor • Static pressure exceeds design specifications
Insufficient Cooling	• Environmental conditions exceed design specifications • Clogged air filter • Clogged fins • Set point temperature exceeds room temperature • Defective room temperature thermistor • Exhaust outlet not properly ducted • Leak in refrigerant system • Restriction in refrigerant system
Display not working	• Compressor not operating
Compressor not operating	• Set point temperature exceeds room temperature • Unit is operating in Fan Only Mode (Cool Mode not activated) • Defective Condensate Pump • Defective Compressor Capacitor • Defective Thermistor • Defective Compressor Motor • Check wiring connections • Defective Relay Board • Defective Control Board
Evaporator or Condenser Fan Motor(s) not operating	• Fan mode DIP switch is set to “Stop” and current Set Point Temperature exceeds Room Temperature • Fan mode DIP switch is set to “Stop” and unit has Condensate Pump that is defective • Check wire connections • Defective fan motor capacitor • Defective fan motor • Defective Relay Board • Defective Control Board

In case of trouble, perform the following inspection before disassembly.

6. Inspection of Plate Fins

To inspect the plate fins of either the evaporator or condenser you must remove the air filters. After removal of the air filters, inspect the plate fins for any dirt, dust, lint, or debris that may have caused poor cooling performance of the unit. If cleaning of the fins is necessary, it is recommended that this service be performed by a qualified service technician.

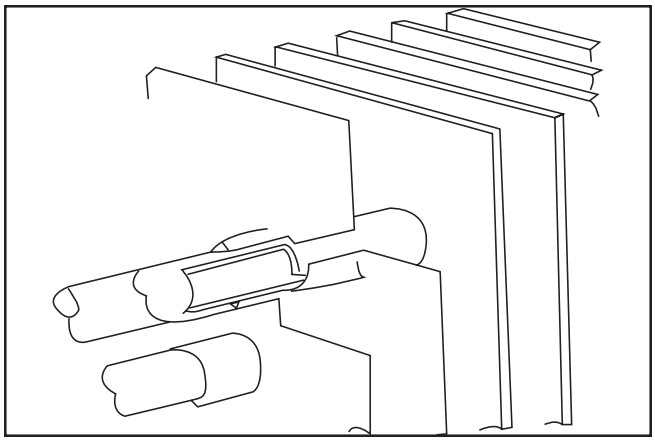
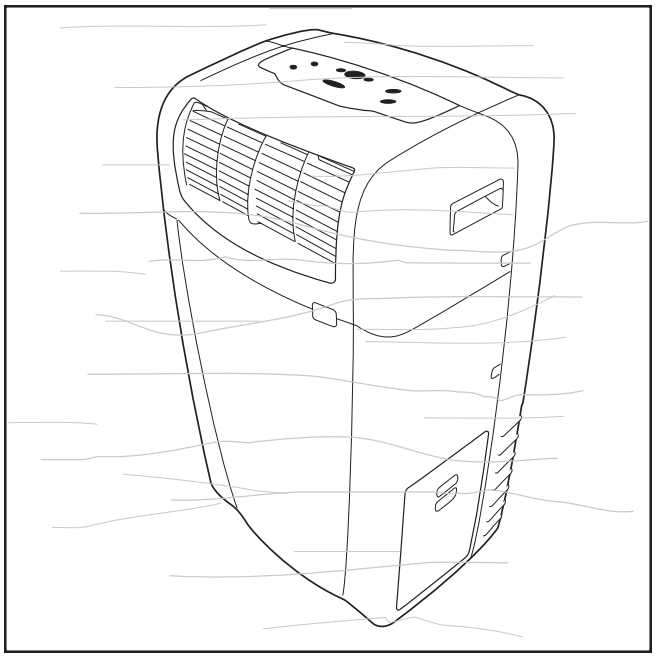


Plate Fins

7. Examination of Operating Environment

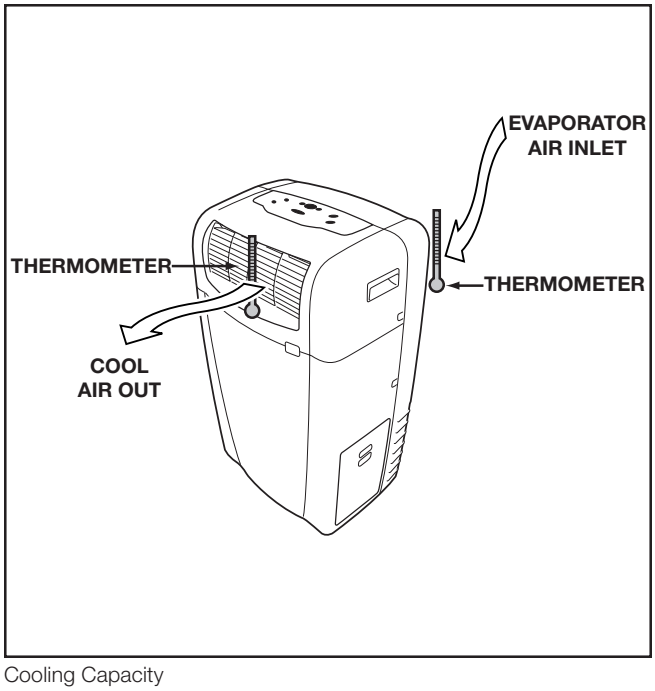
Operating environments will vary depending on location, climate and surrounding conditions. Installation location also can cause operational problems. Consult your reseller concerning operational environment requirements.



Operating Environment

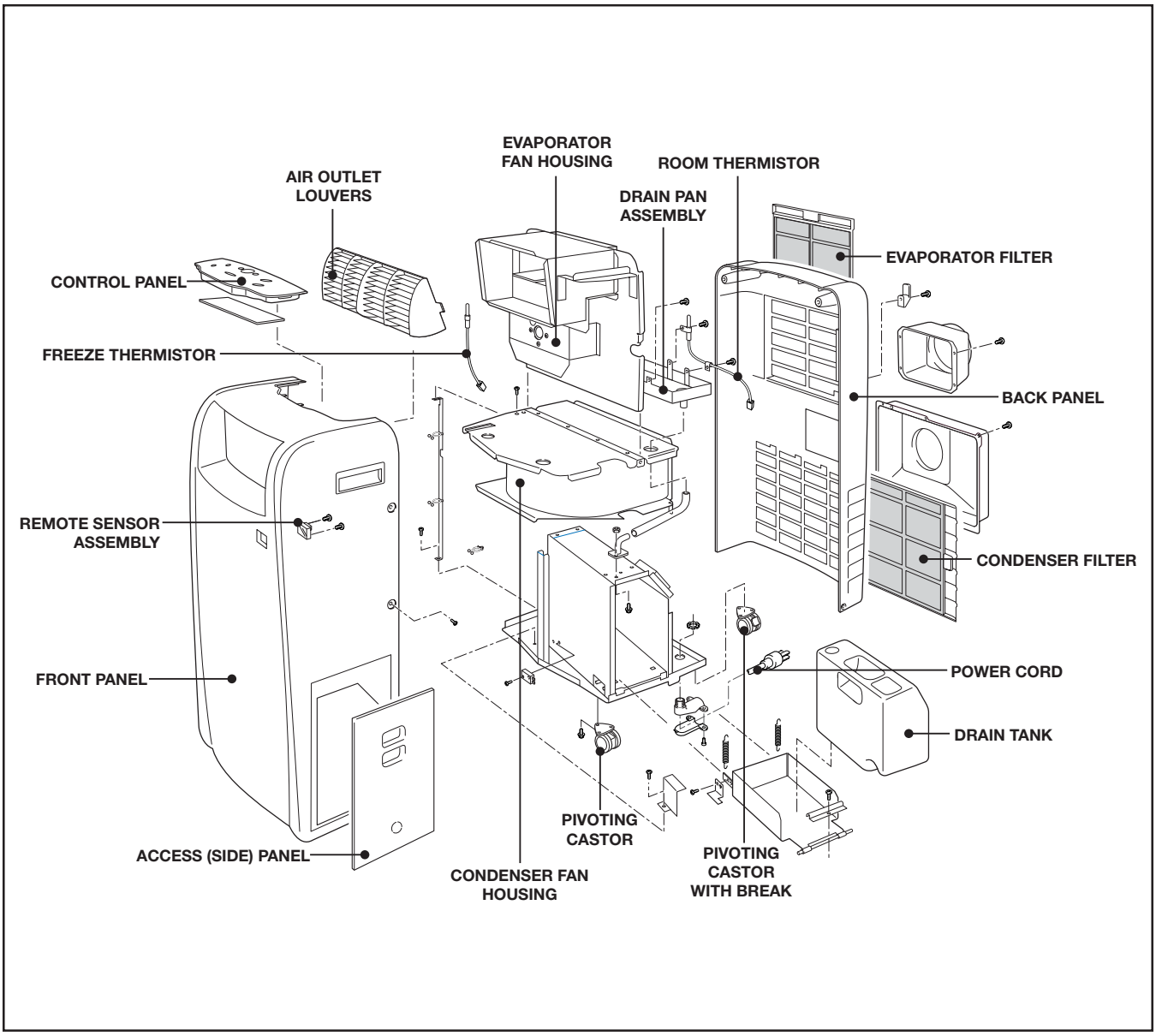
8. Inspection of Cooling Capacity

Measure the difference in temperature between the inlet of the evaporator and the cool air vent. If the difference is out of the range given in the graphs on page 8, proceed with the possible causes suggested in the troubleshooting chart on page 24.



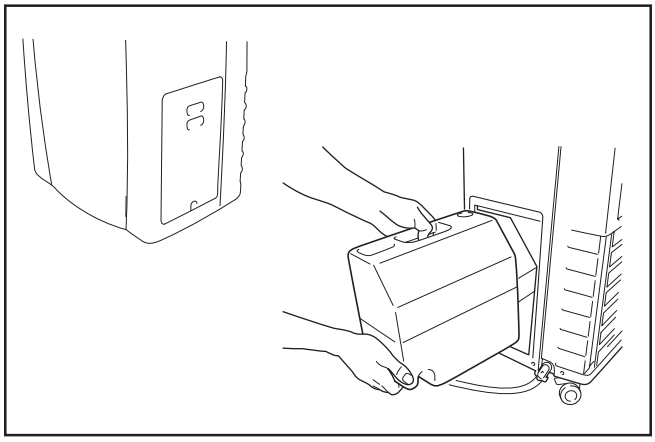
Cooling Capacity

9. Disassembly



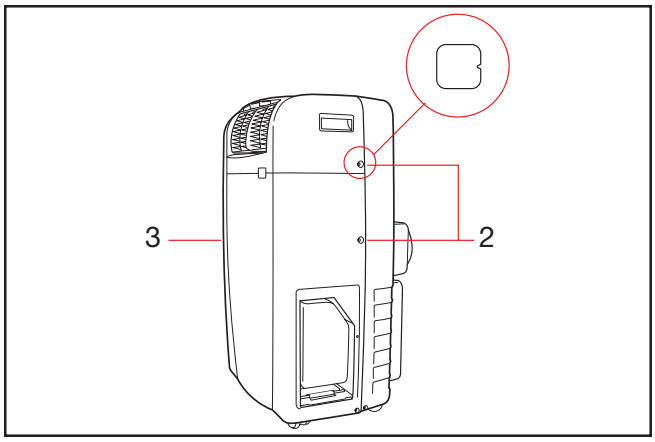
Disassembly

A. Remove the drain tank.



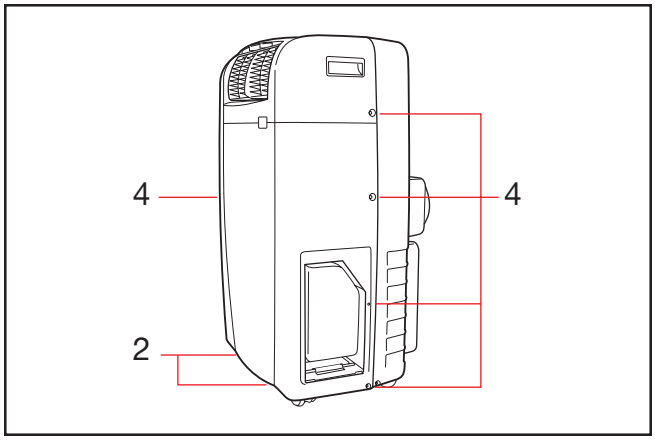
Removal of Drain Tank

B. Remove five (5) plastic caps with a small screw driver or pin.



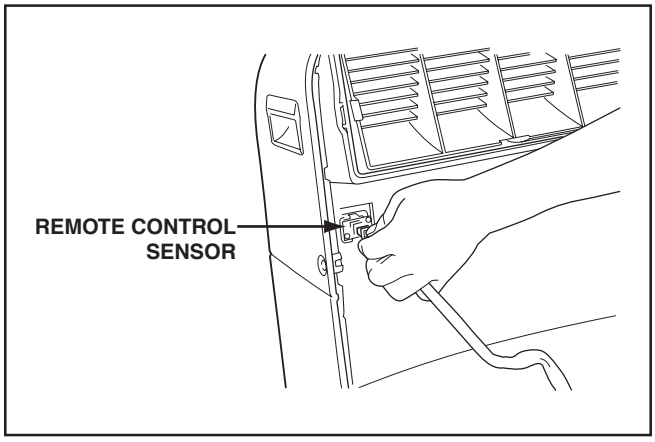
Removal of Caps

C. Remove the ten (10) screws from the front panel.



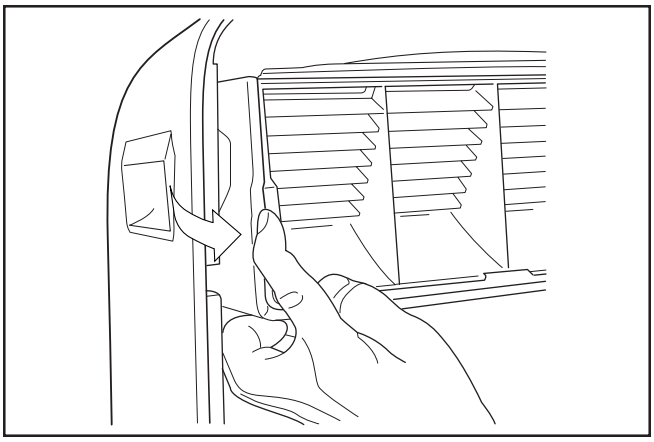
Removal of Front Panel Screws

D. Slide front panel forward and disconnect the remote control sensor wire harness. Unscrew one (1) screw to remove the remote control sensor.



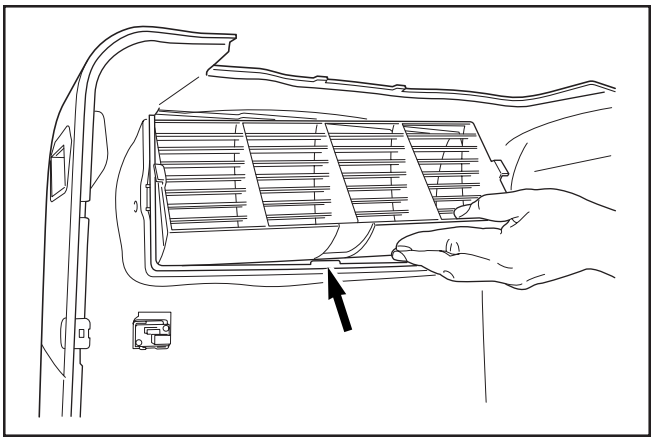
Removal of the Remote Control Sensor Wire Harness

TROUBLESHOOTING AND REPAIR



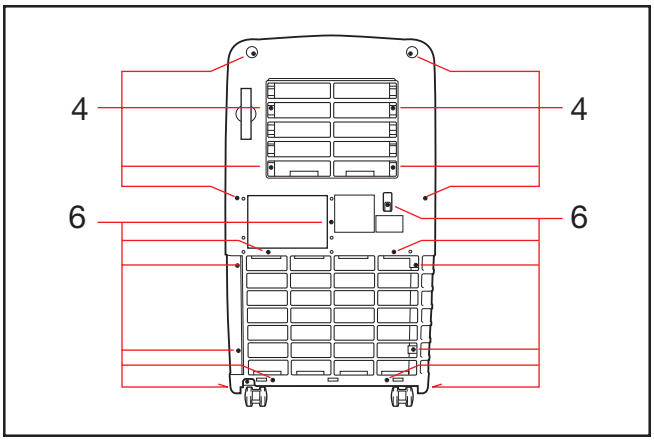
Removal of Air Outlet Louver

E. Louver can be removed from upper front panel by unsnapping the lock tab and removing the louver from its pivots.



Removal of Air Outlet Louver (continued)

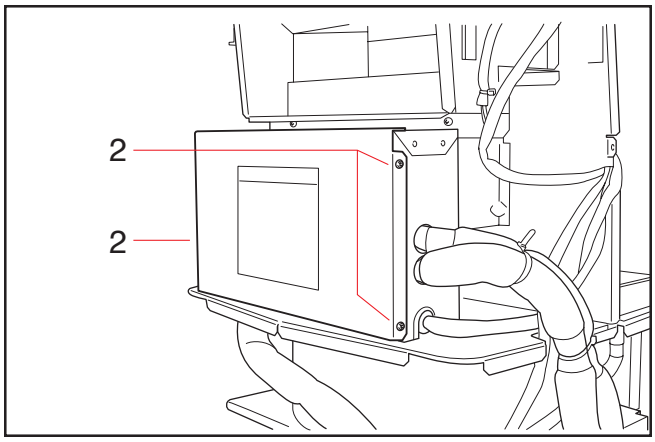
F. Gently push air louver up. Then pullout to remove.



Removal of Rear Panel

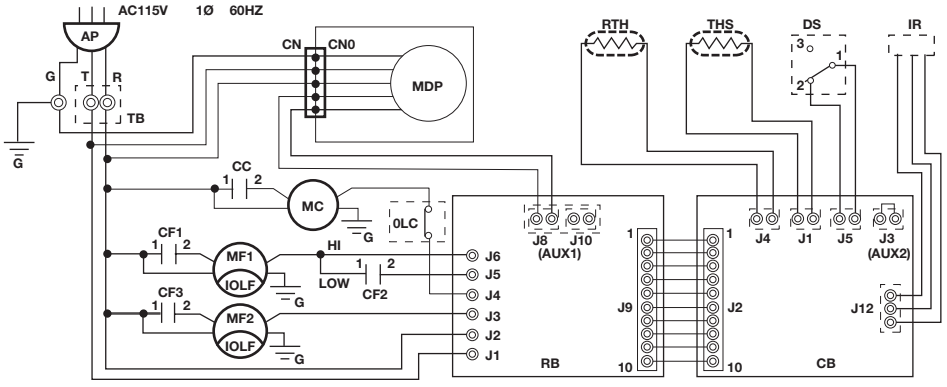
G. Remove twenty (20) screws from the rear panel.

H. Remove four (4) screws from the electrical box cover.

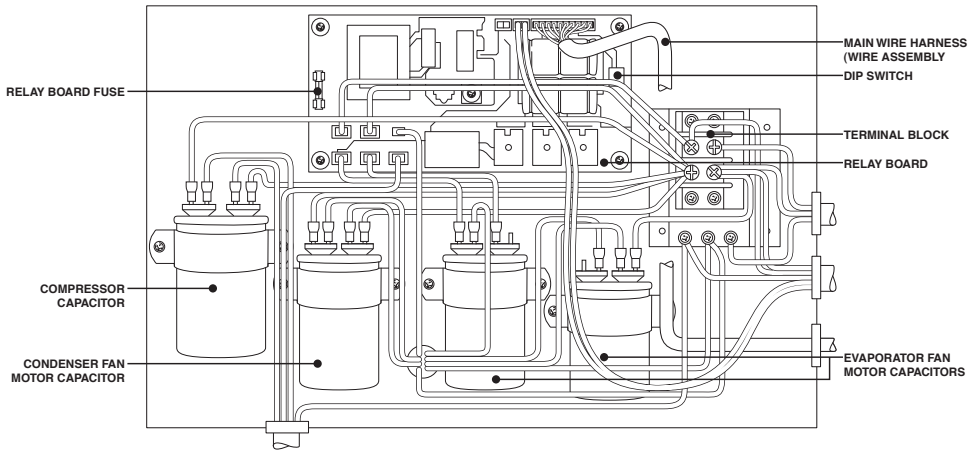


Removal of Electric Box Cover

10. Removal of Electrical Parts

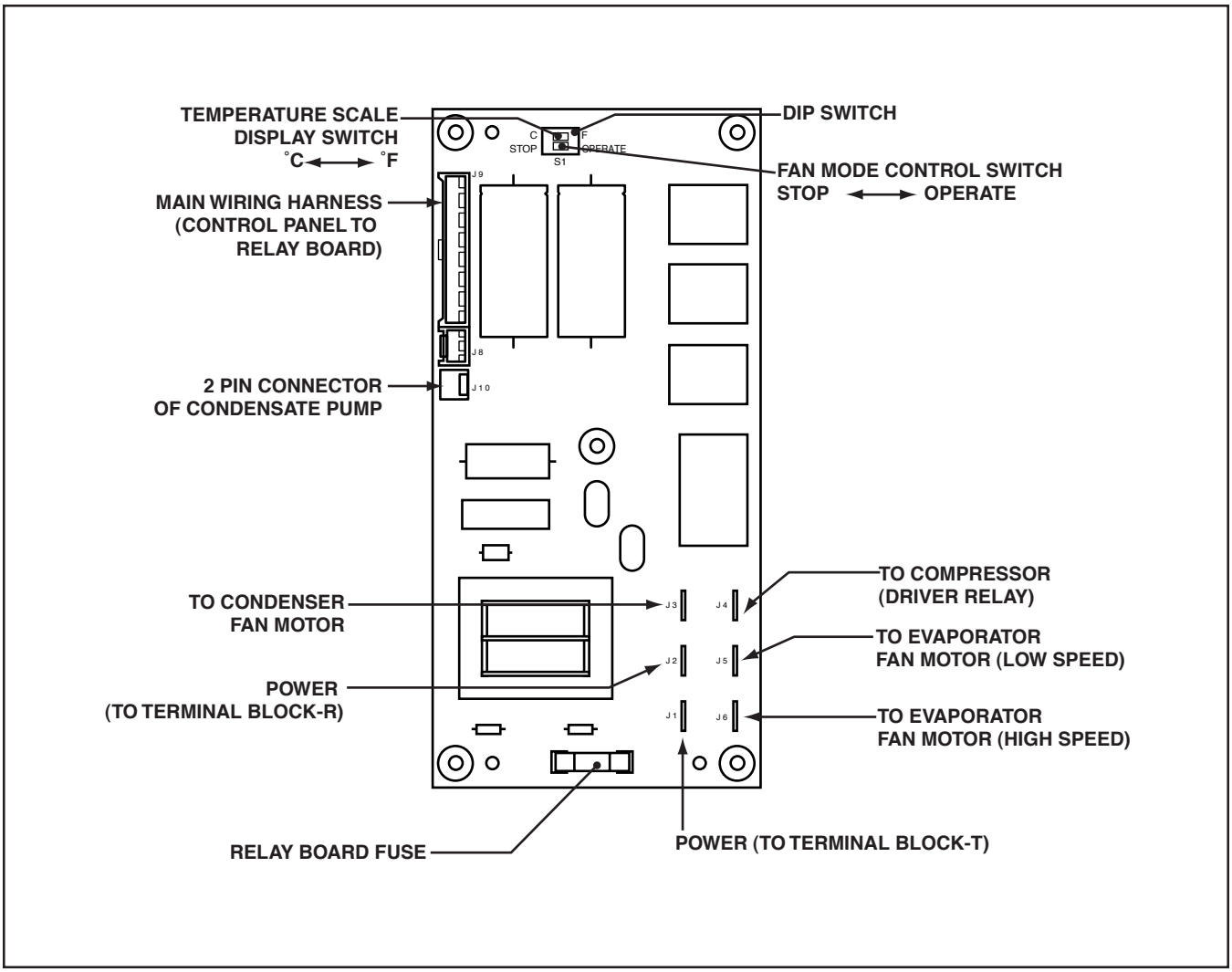


AP	Attachment Plug	OLC	Overload Relay of Compressor
TB	Terminal Block	DS	Full Drain Warning Switch
CB	Control Board	THS	Freeze Protection Thermistor
RB	Relay Board	RTH	Room Thermistor
MF1	Fan Motor of Evaporator	IR	Remote Receiver Board
MF2	Fan Motor of Condenser	G	Ground
MC	Compressor Motor	CN	Connector for Drain Pump (Unit Side)
CF1	Capacitor for Fan Motor of MF1	CNO	Connector of Drain Pump (Pump Side)
CF2	Capacitor for Fan Motor of MF1	MDP	Drain Pump
CF3	Capacitor for Fan Motor of MF2		
CC	Capacitor for Compressor	AUX1	Auxiliary Connector
IOLF	Internal Overload Relay of Fan Motor	AUX2	Auxillary Connector / Jumper

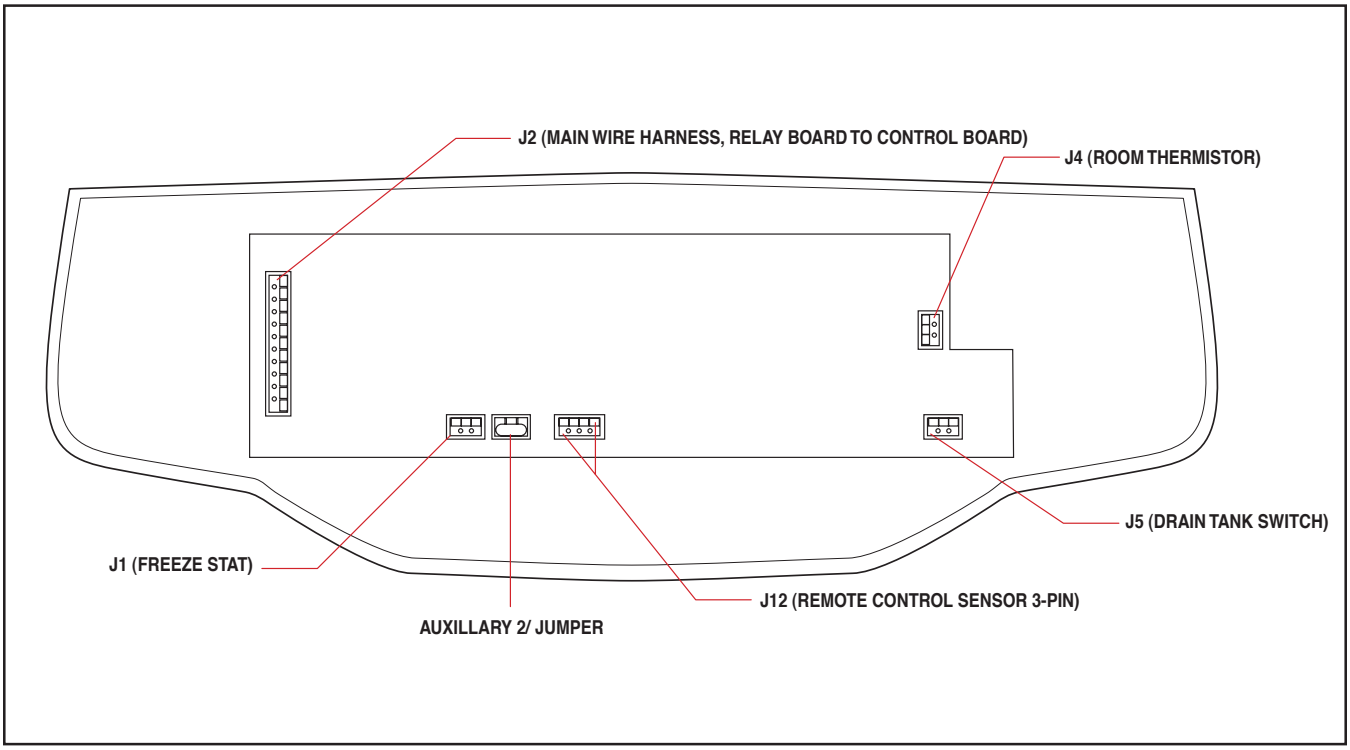


Removal of Electrical Parts in the Control Box

TROUBLESHOOTING AND REPAIR

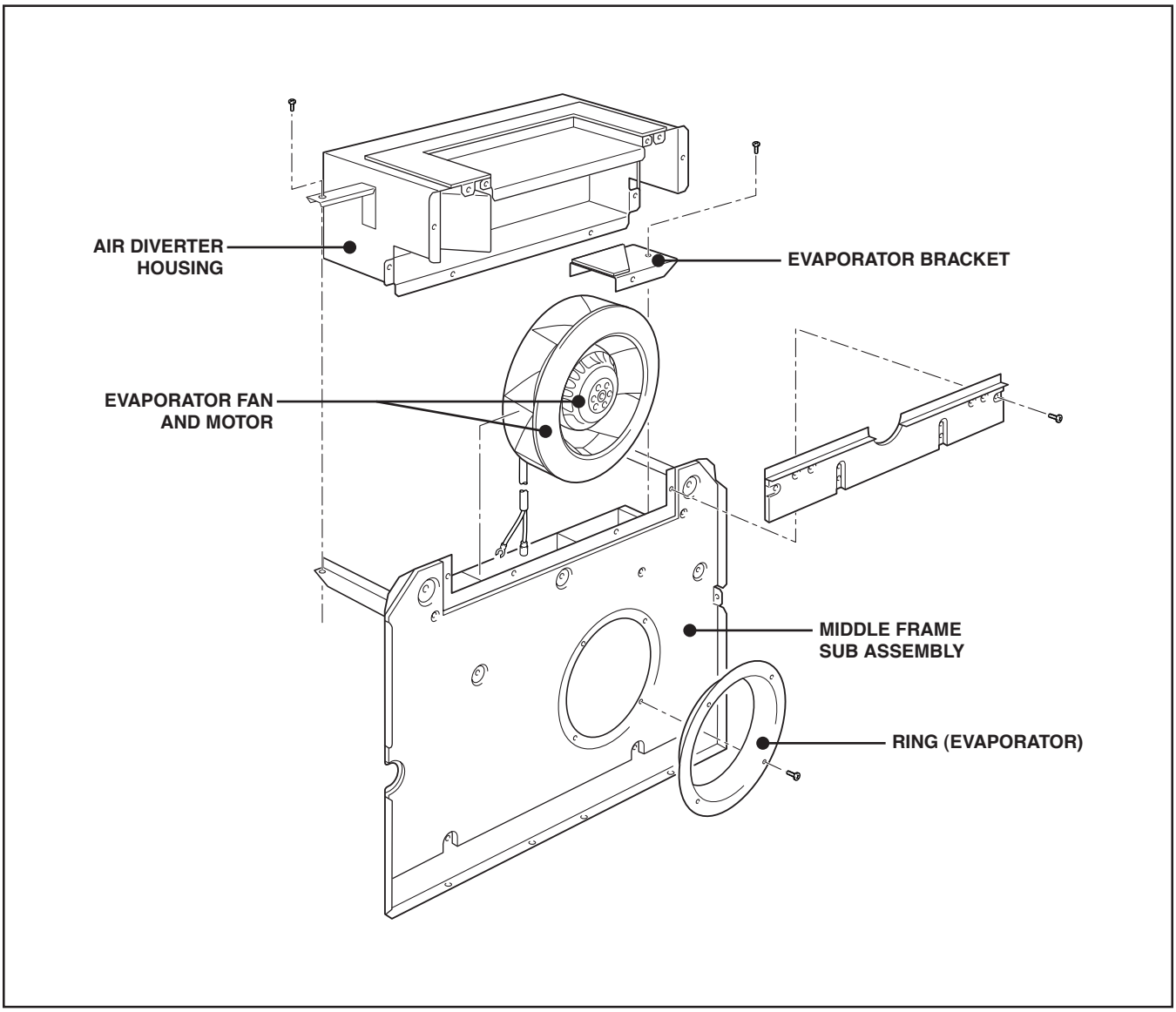


Connections to Relay Board



Connections to Control Board

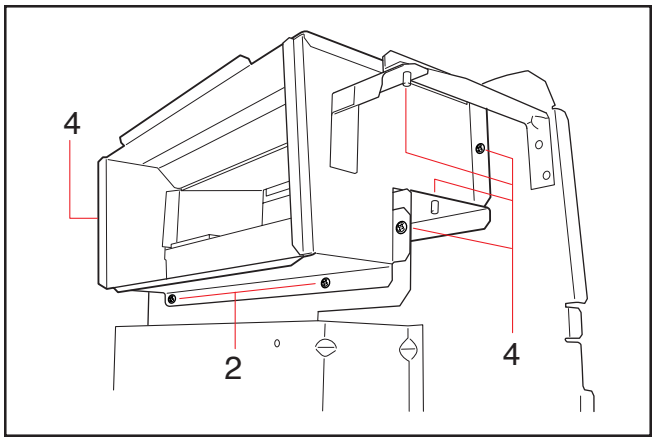
11. Removal of Blower Assembly



Disassembly of the Evaporator Fan Housing

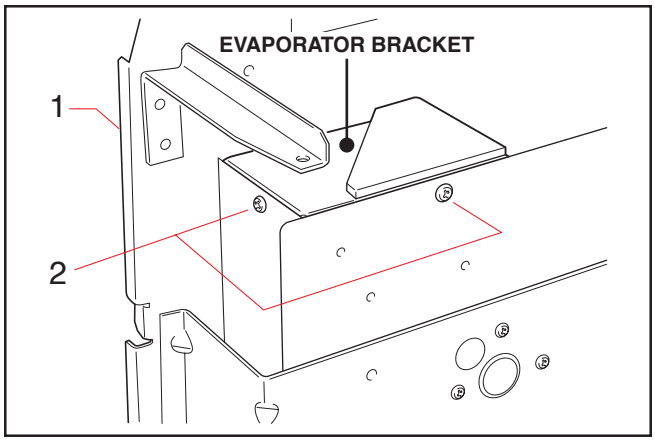
12. Removal of Evaporator Fan Motor

A. Remove the ten (10) screws from the air diverter housing.



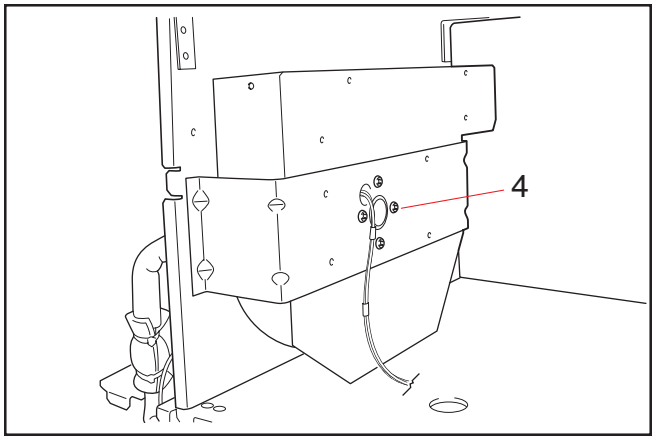
Removal of Air Diverter

B. Remove the three (3) screws from the evaporator housing bracket.

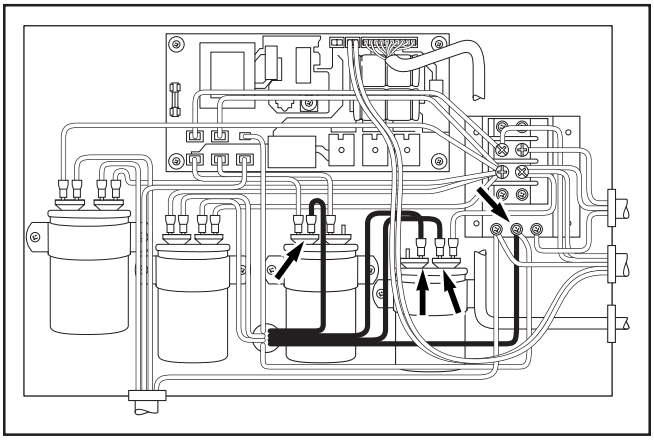


Removal of Evaporator Bracket

C. Remove the four (4) screws holding the evaporator motor to the evaporator fan housing.

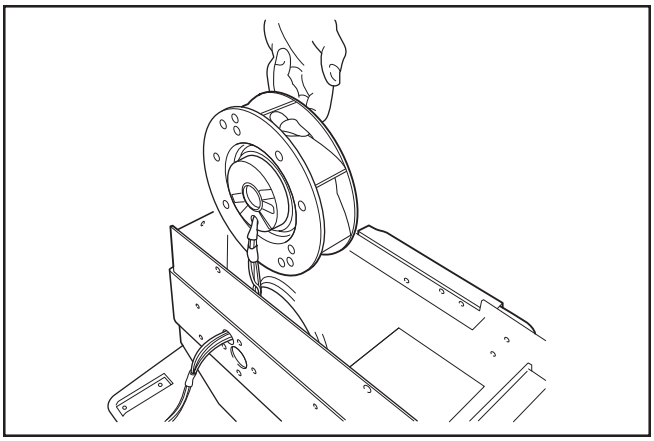


Evaporator Fan Removal



Wiring From the Capacitors to Evaporator Fan Motor

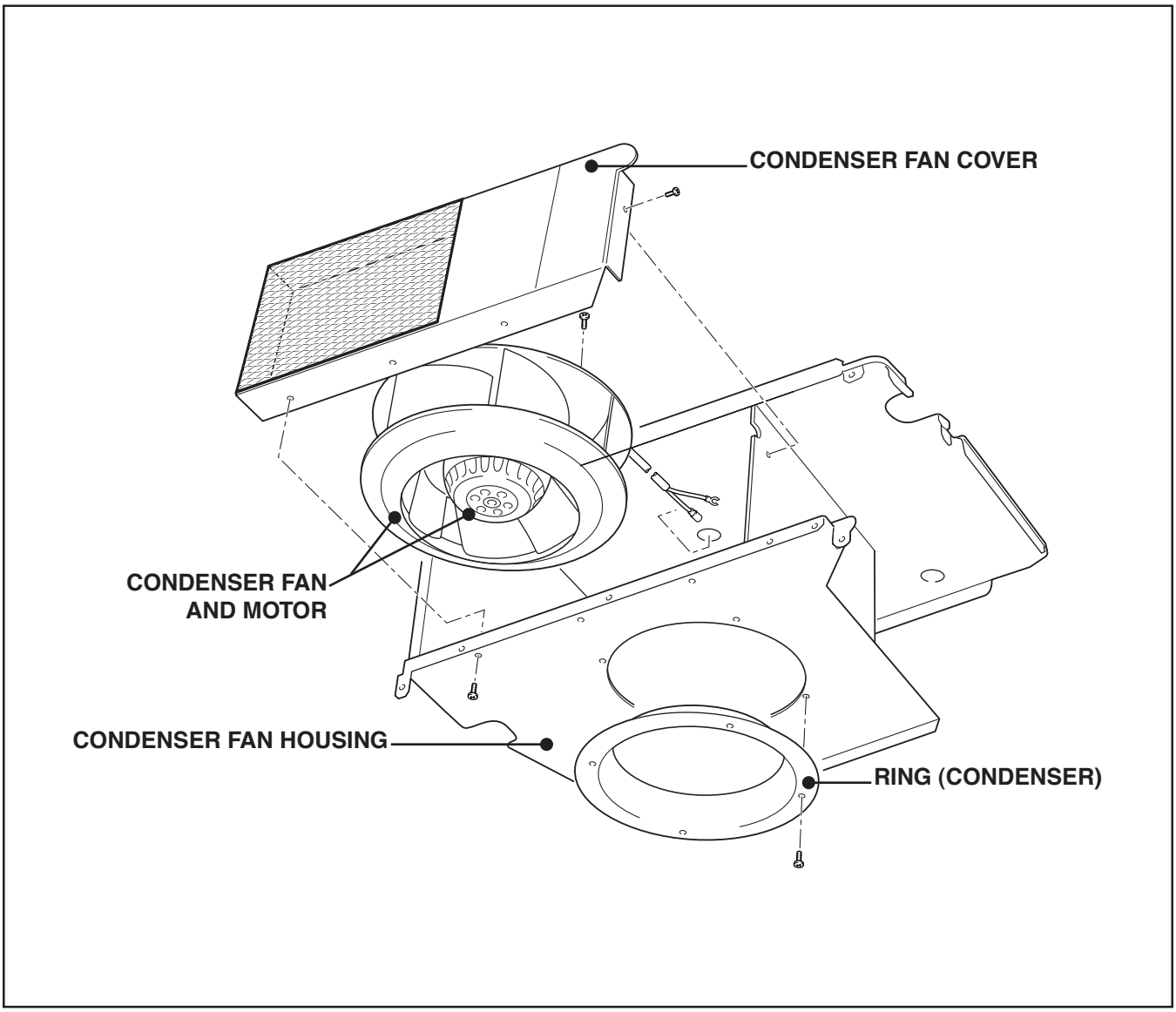
D. Tag all evaporator fan wires then remove wires as shown.



Removal of Evaporator Fan Motor

E. Slowly pull the evaporator fan out from the evaporator fan housing.

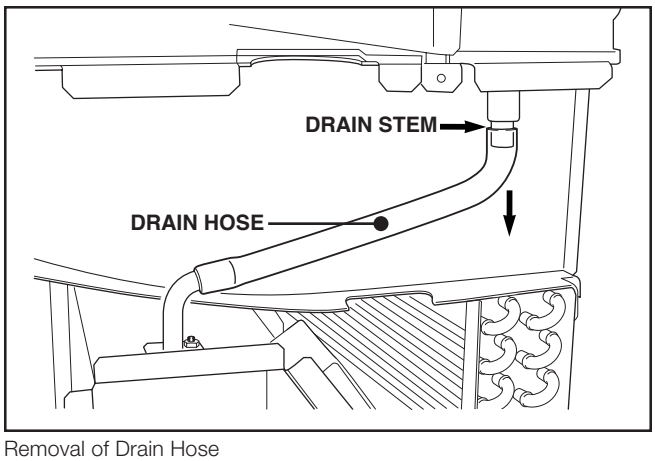
13. Removal of Condenser Housing Assembly



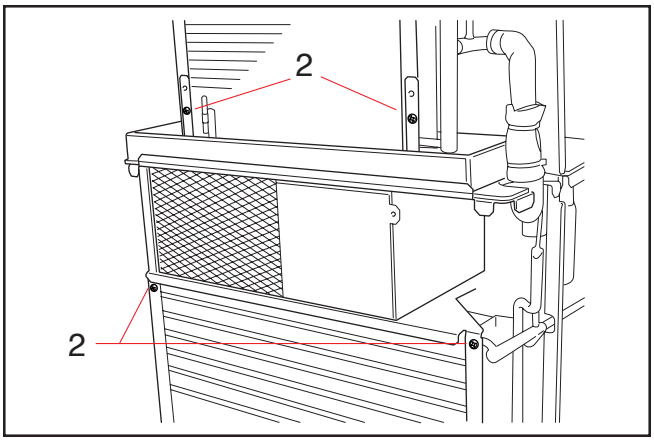
Disassembly of Condenser Fan Housing

14. Removal of Condenser Fan Motor

A. To access the condenser fan, the evaporator fan housing and the drain pan must be removed.
Remove the drain hose from the drain stem.

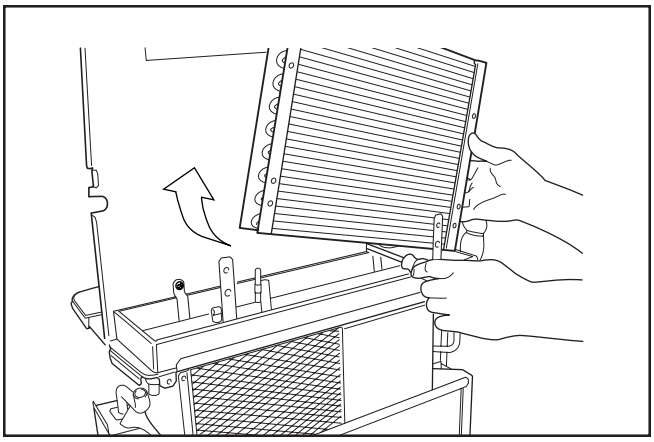


Removal of Drain Hose



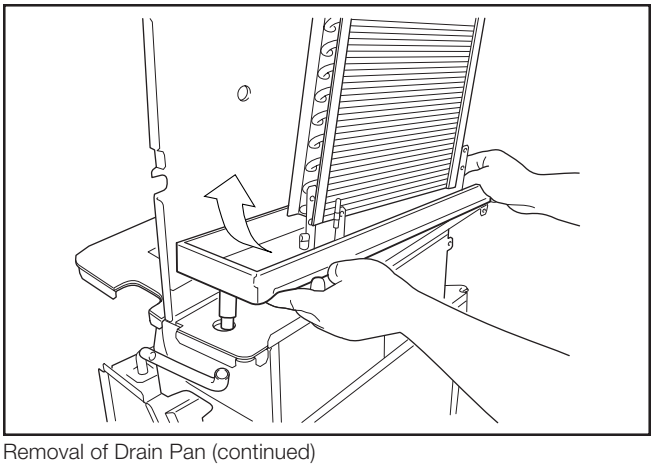
Removal of Evaporator Stay

B. Remove the two (2) screws from the two evaporator stays. Remove the two (2) screws from the condenser stays.



Removal of Drain Pan

C. Gently tilt the evaporator to access the drain screws. Remove the two (2) screws.

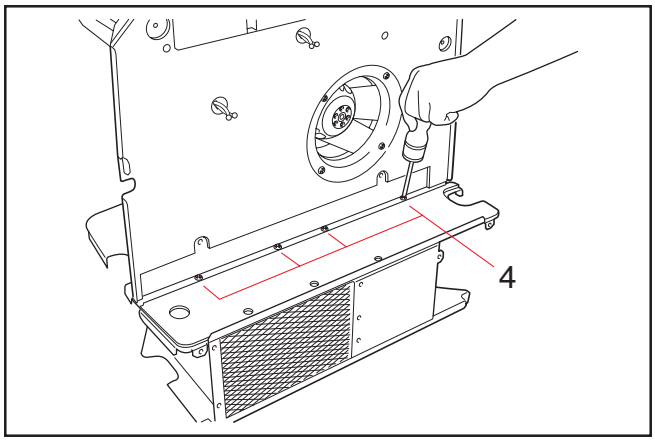


Removal of Drain Pan (continued)

D. Pivot the drain pan up. Slide the drain pan out as shown.

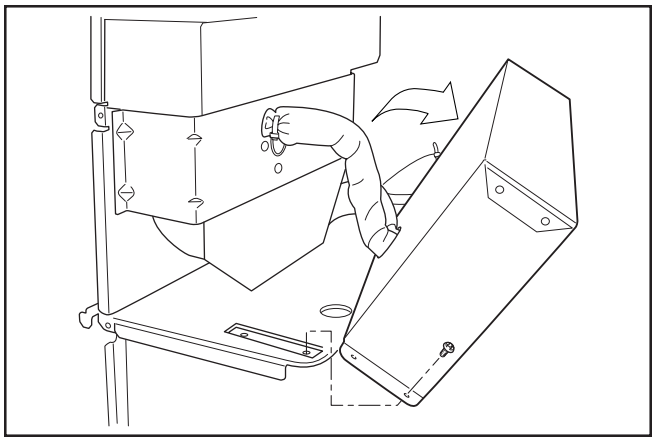
15. Removal of Evaporator Fan Housing

A. Remove four (4) screws on the evaporator fan housing.



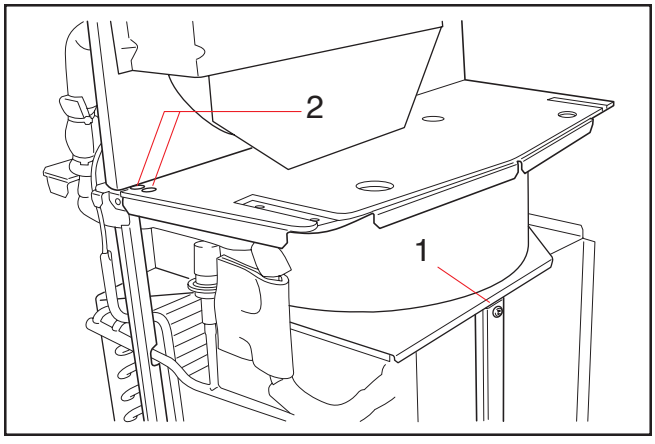
Removal of Screws for Evaporator Fan Housing

B. Remove four (4) screws from the electric box. Set aside the electric box.

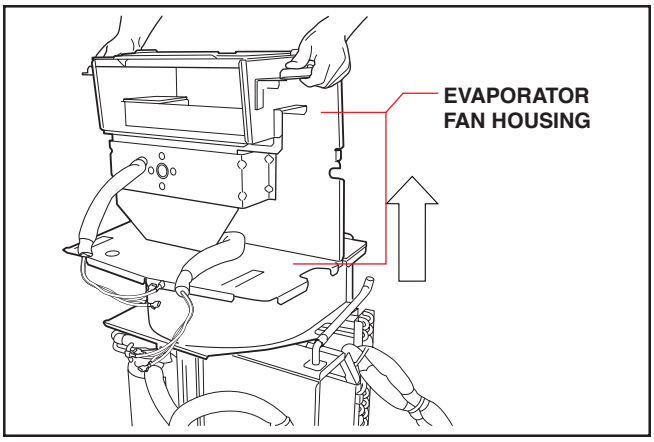


Removal of Electric Box

C. Remove three (3) screws from the condenser fan housing and stay.

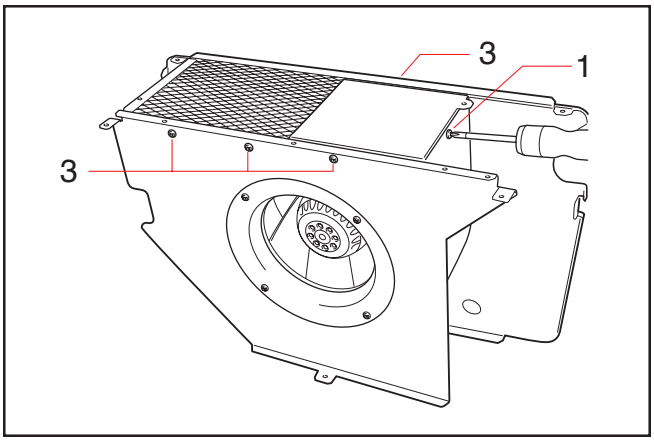


Removal of Fan Motor (Evaporator) - continued



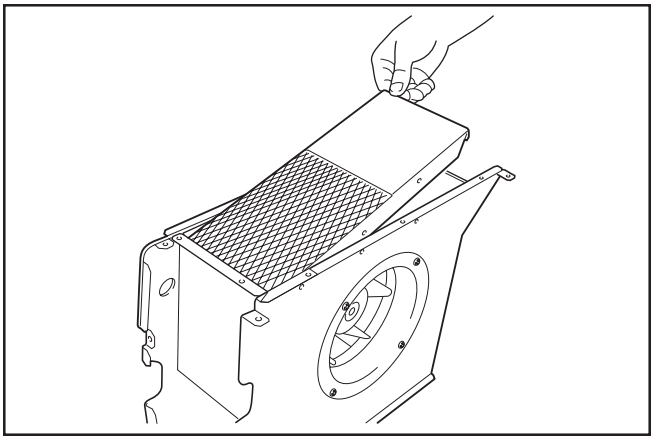
Removal of the Evaporator Housing

D. Remove the evaporator fan housing from the condenser fan housing.



Removal of the Condenser Fan Cover on the Condenser Fan Housing

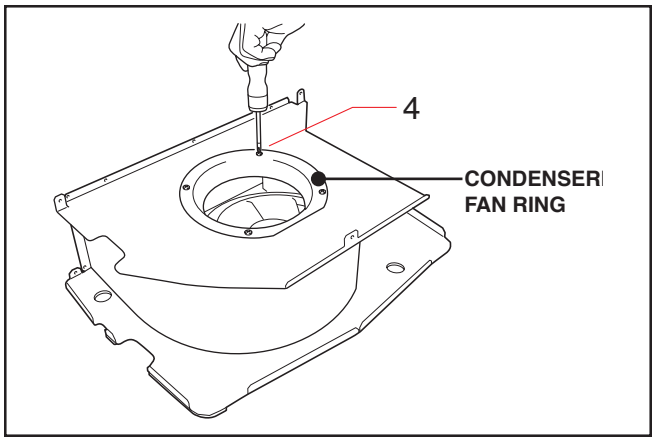
E. Remove seven (7) screws from the condenser fan housing.



Removal of Protective Screen Housing

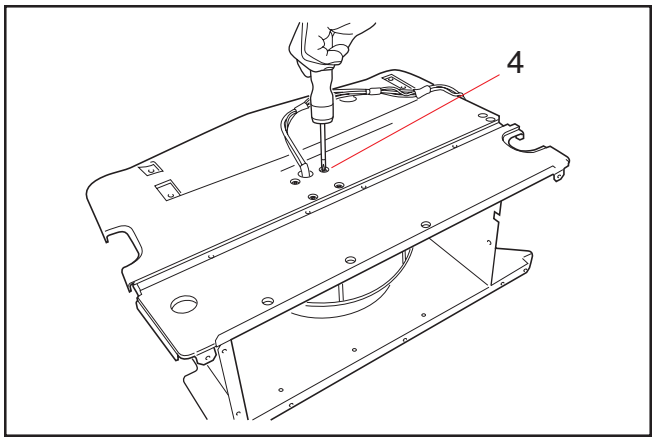
F. Slide the condenser fan cover out of the condenser fan housing.

G. Remove the four (4) screws for removal of the condenser fan ring subassembly.



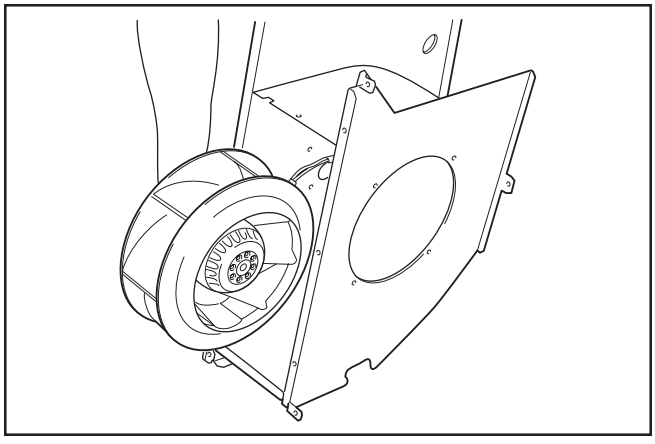
Removal of Condenser Fan Ring Sub-Assembly

H. Remove the four (4) screws from the condenser fan housing.

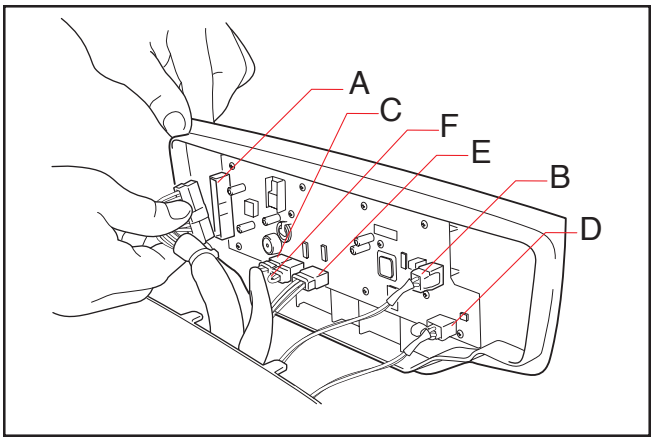


Removal of Condenser Fan Screws

I. Remove the condenser fan from the housing.



Removal of the Condenser Fan Motor



Removal of Control Board

16. Removal of Control Board

A. Disconnect the following connectors from the control board:

(A) Main Wire Harness, Relay Board to Control Board J2 (10-pin)

(B) Room Thermistor J4 (2-pin)

(C) Freeze Thermistor J1 (2-pin) with black tape

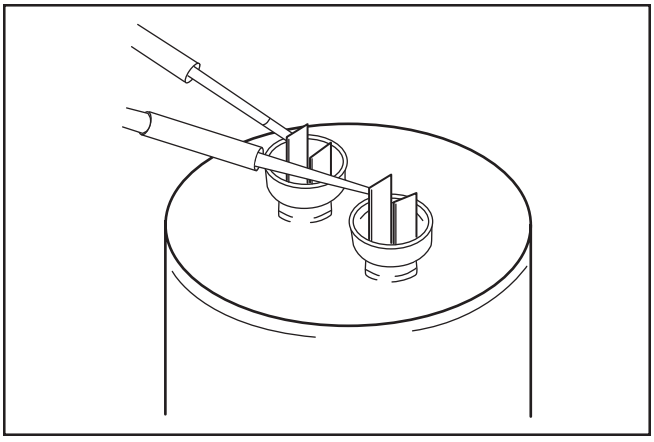
(D) Drain Tank Switch J5 (2-pin)

(E) Remote Control Sensor J12 (3-pin)

(F) Auxillary 2 / Jumper

NOTE: Mark each of the 2-pin connectors with a different color marker to ensure the correct orientation when they are reconnected or label all

2-pin connectors with tape. Label A thru D as shown, then repeat for all wire sets.


Inspection of Capacitor

17. Inspection of Capacitor (for Fan Motors and Compressor)

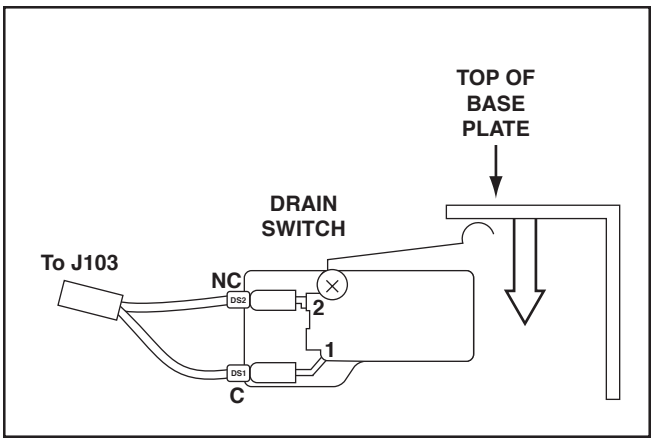
Ohmeter Method - Set the ohmeter to the 100KΩ range. Place the two probes against the tow terminals of the capacitor. At first, the ohmeter should indicate 0Ω, then the reading should gradually increase towards infinity(∞). This indicates that the capacitor is charging. If the reading indicates infinity right away (shorted) or the ohmeter fails to move from 0Ω (open), replace the capacitor.

18. Capacitance Tester Method

Using a capacitance tester and the chart on page 17, test the capacitor for the value indicated. If the value tested is <u>not</u> within 10% of indicated capacitance, replace the capacitor.

⚠WARNING: Properly discharge the capacitor(s) before testing and after testing has been completed. Failure to do so could cause damage to

test equipment or the unit and/or result in personal injury (electrical shock) or death.



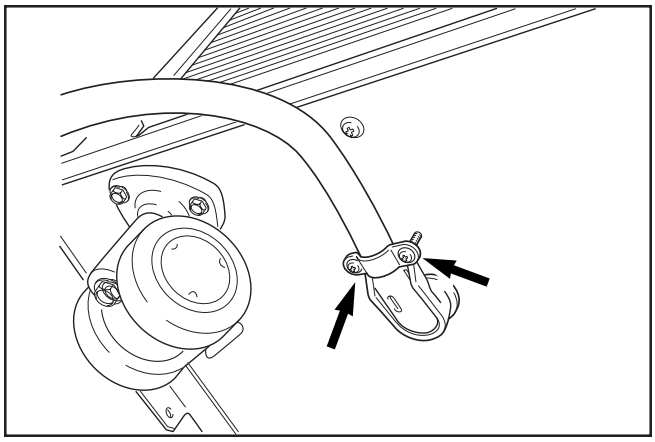
Inspection of Drain Switch

19. Inspection of Drain Switch

Check for continuity between terminals 1 and 2. Continuity should exist. With switch depressed, no continuity should exist between terminals 1 and 2. If continuity is not as specified above, replace the switch.

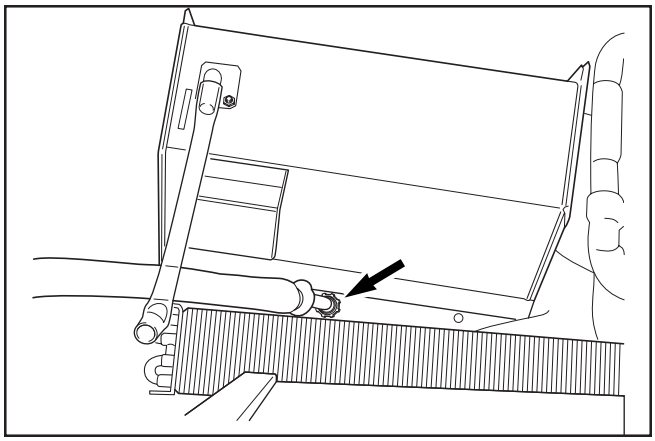
20. Removal of Power Cord

A. Remove the two (2) screws from the connector located under the base of the unit.



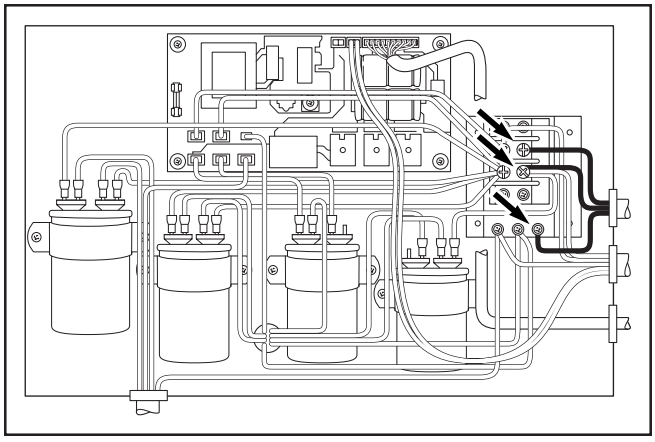
Removal of Power Cord Connector

B. Loosen the retainer from the base of the unit.

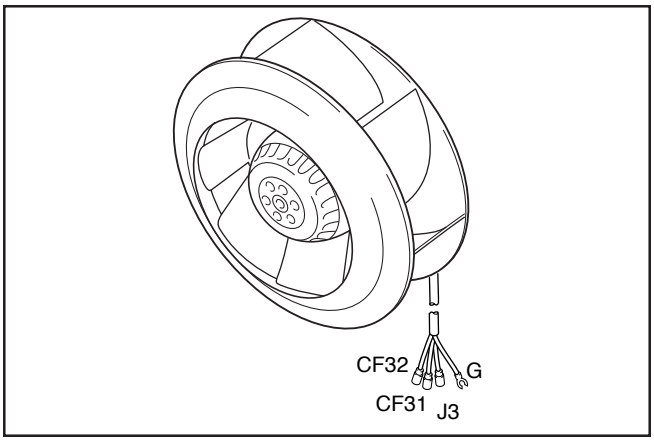


Removal of Power Cord Retainer

C. Disconnect the three (3) lead wires of the power cord.



Removal of Power Wiring from Terminal Block



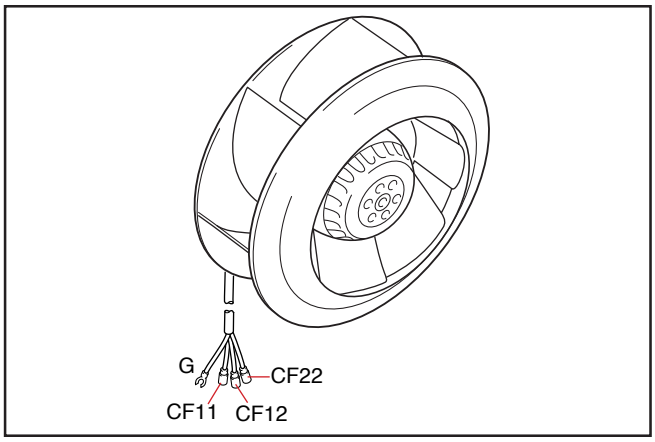
Inspection of Condenser Fan Motor

21. Inspection of Condenser Fan Motor
Measure resistance across the terminals of the fan motor.

Terminals (at 77˚F (25˚C))

J3-CF32	Approx. 9.0Ω
J3-CF31	Approx. 8.83Ω
CF31-CF32	Approx. 18Ω

If the measured resistance does not approximately equal these standard values ±10%, replace the fan motor.



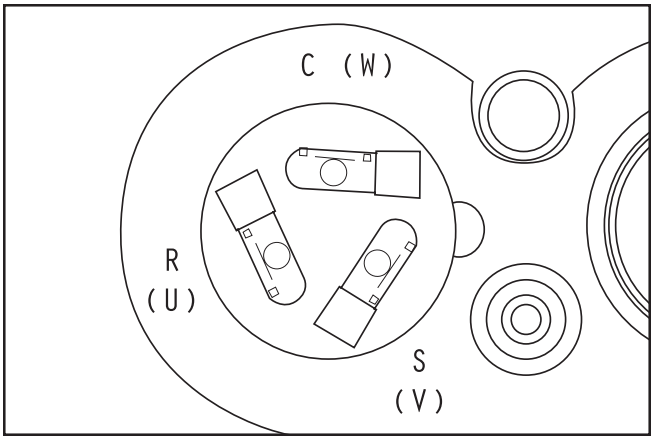
Inspection of Evaporator Fan Motor

22. Inspection of Evaporator Fan Motor
Measure resistance across the terminals of the fan motor.

Terminals (at 77˚F (25˚C))

CF11-CF22	Approx. 52.8Ω
CF22-CF12	Approx. 50.7 Ω

If the measured resistance does not approximately equal these standard values ±10%, replace the fan motor.



Inspection of Compressor Motor

23. Inspection of Compressor Motor
Measure resistance across the terminals of the compressor motor.

Terminals (wire tag) at 77˚F (25˚C)

R-C (CC1-J4)	Approx. 1.0Ω
C-S (J4-CC2)	Approx. 2.2Ω
S-R (CC2-CC1)	Approx. 3.0Ω

If the measured resistance does not approximately equal these standard values ±10%, replace the compressor.

24. Inspection of Wiring Connection
Refer to the Wiring Diagrams on page 45 and check for connection of each wire.

25. Inspection of Thermistor
Using an Ohmeter, check the resistance value across the 2-pin connector. At normal temperature (77˚F (25˚C)) either thermistor (room or freeze) should measure approximately 10,000 or 10K ohms.

26. Inspection

In most cases, the probable cause for insufficient cooling is a clogged system, too much static pressure refrigerant leakage, or an incorrect amount of refrigerant. In such cases, inspect the system according to the following procedure.

A. Inspection of Clogged System - Check the component parts of the refrigerant system, including piping, that could be clogged with refrigerant. If clogged with refrigerant, only the clogged part is frosted partially. In such a case, change the part in question.

B. Inspection of Refrigerant Leak - Carefully check all connections, and each component for leaks whenever the refrigerant system is installed or repaired. Use an electronic gas leak tester to inspect the system.

C. Insufficient Refrigerant - In case the unit is judged to be deficient in cooling capacity, be sure to perform the inspections in
26A and 26B to confirm the cause of trouble. After that, charge the system with refrigerant to the specified amount.

27. Repair of Refrigerant System

In case there is a leak, obstruction, or trouble in the refrigerant system of the Spot Cooling System, replace or repair the part in question. After replacing any component all connections must be brazed.

A. Proper Brazing Techniques

It is desirable to use a slightly reducing flame. Oxyacetylene is commonly used since it is easy to judge and adjust the condition of the flame. Unlike gas welding, a secondary flame is used for brazing. It is necessary to preheat the base metal properly depending on the shape, size or thermal conductivity of the brazed fitting.

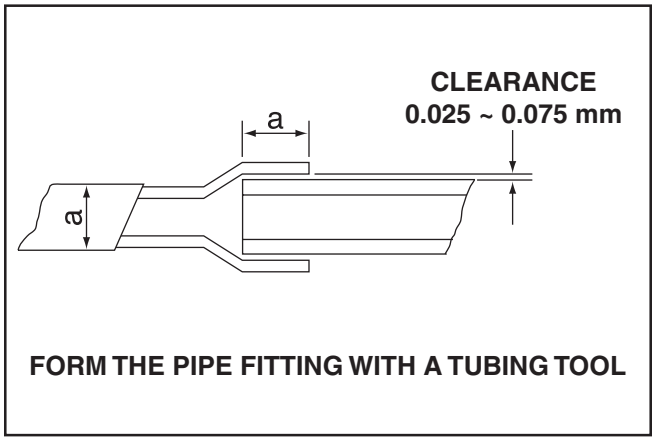
The most important point in flame brazing is to bring the whole brazed fitting to a proper brazing temperature. Care should be taken to not cause overflow of brazing filler metal, oxidization of brazing filler metal, or deterioration due to the overheating of flux.

- BRAZED FITTING AND ITS CLEARANCE

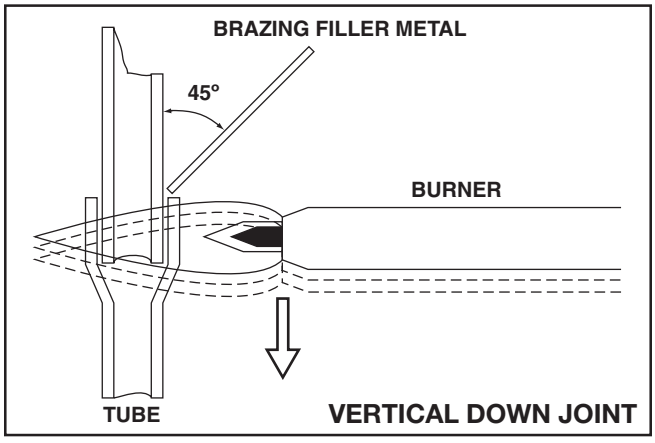
  In general, the strength of brazing filler metal is lower than that of the base metal. So, the shape and clearance of the brazed fitting are quite important. As for the shape of the brazed fitting, it is necessary to *maximize its adhesive area*. The clearance of the brazed fitting must be minimized to facilitate brazing filler metal to flow into it by capillary action.

- CLEANING OF BRAZING FILLER METAL AND PIPE

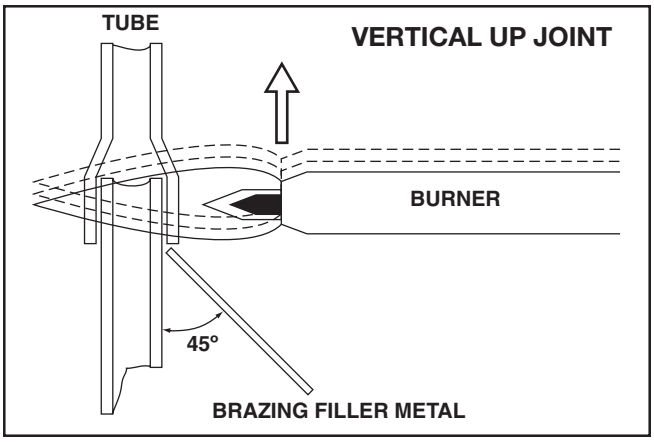
  When the refrigerant system has been opened up, exposure to heat may have caused brazing filler metal to stick to the inside and outside of the pipe. Brazing filler metal may also be compounded with oxygen in the air to form oxide film. Fats and oils may stick to the pipe from handling. All these factors will reduce effectiveness of brazing. It is necessary to eliminate excess brazing filler metal using sand paper and by cleaning thoroughly with a solvent such as Trichlene.



Form the Pipe Fitting



Vertical Down Joint



Vertical Up Joint

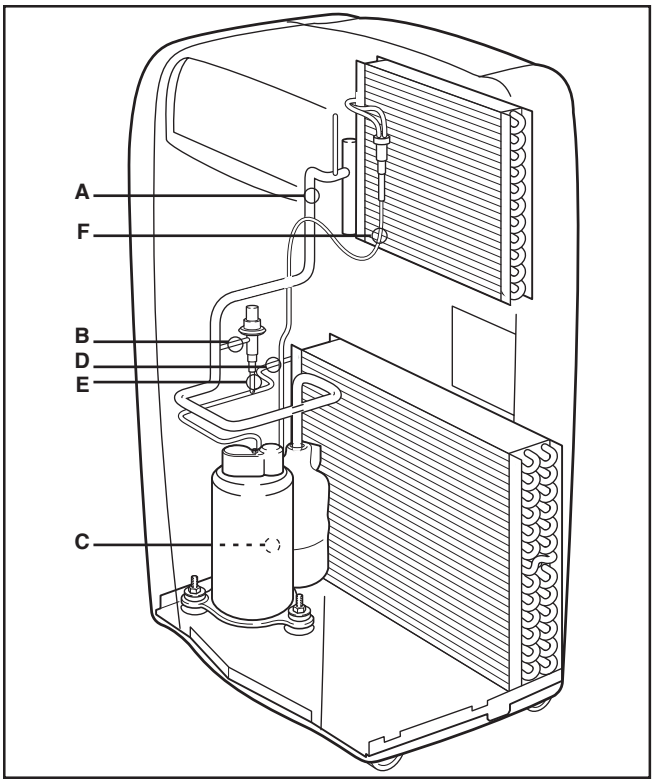
- USE OF DRY NITROGEN GAS

  During brazing, the inside of the pipe undergoes an oxidative reaction due to the brazing flame. Introduce dry nitrogen gas (1l/min.; adjust with the flow regulator) through the pinch-off tube of the refrigerant cycle to prevent oxidation.

NOTE: Take care not to allow dirt, water, oil, etc. to enter into the pipe

- VERTICAL JOINT

  Heat the whole brazed fitting to a proper brazing temperature. Bring the brazing filler metal into contact with the fitting so that the brazing filler metal starts flowing by itself. Stop heating the fitting as soon as the brazing filler metal has flown into the clearance. Since the brazing filler metal flows easily into the portion heated to a proper temperature, it is essential to keep the whole fitting at a proper brazing temperature.



Refrigeration Cycle Components

B. Removal of Refrigeration Cycle Components

⚠CAUTION

1. **Before any refrigeration cycle component can be replaced, it is necessary to recover the refrigerant using standard recovery procedures and equipment.**
2. **To prevent oxidation, dry nitrogen should be conducted (flow rate 1l/min) through the pinch-off tube during any brazing operation.**
3. **During any component replacement involving brazing, shield nearby parts with a steel plate, asbestos, etc., to protect them from the flame.**

(1) Evaporator
(2) Capillary tube
(3) Condenser
(4) Compressor

NOTE: Hold the compressor body, not the tube, when carrying the compressor.

PART TO REPLACE	DISCONNECT AT
COMPRESSOR ASSY	A & D
CONDENSER	D & C (Point C is located behind the Compressor)
SUCTION REGULATING VALVE	B & E
EVAPORATOR ASSY	C & A
CAPPILARY TUBE	C & F

28. Charging the System with R-22 Refrigerant

Always ensure that the refrigerant system has been properly evacuated before charging with the specified amount of R-22.

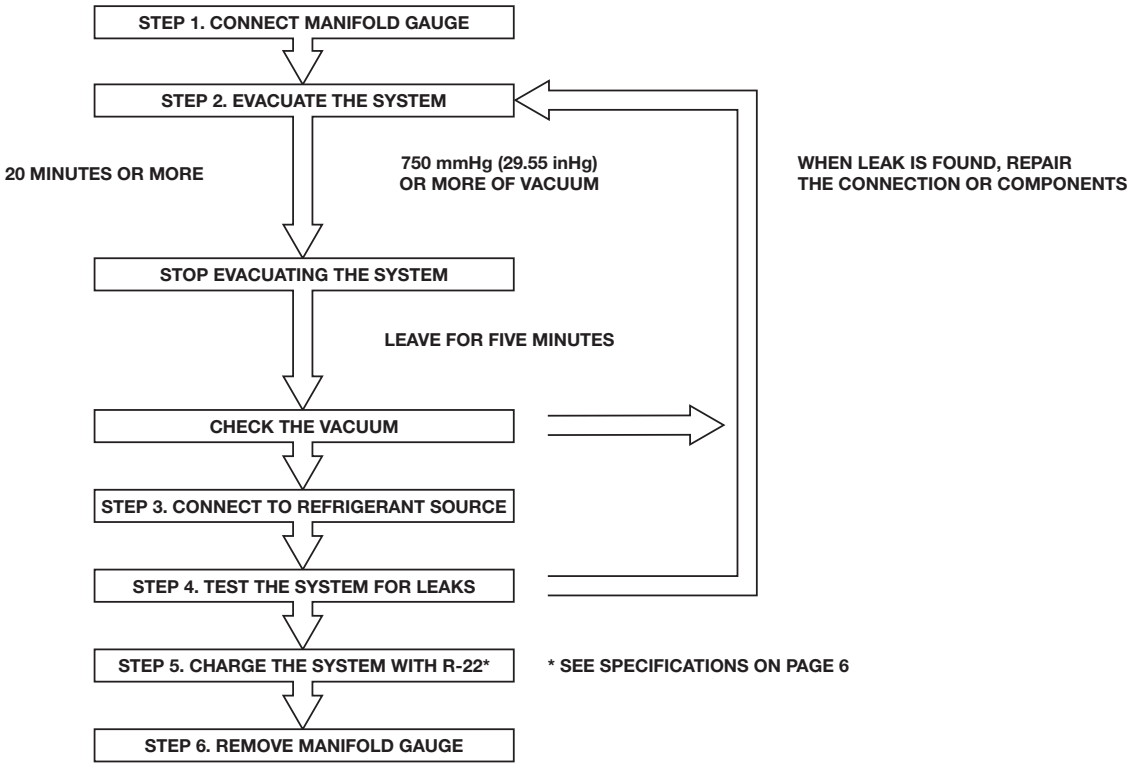
⚠WARNING

When handling refrigerant (R-22), the following precautions should always be observed:

- **Always wear proper eye protection while handling refrigerant.**
- **Maintain the temperature of the refrigerant container below 40˚C (104˚F).**
- **Perform repairs in a properly ventilated area. (Never in an enclosed environment.)**
- **Do not expose refrigerant to an open flame.**
- **Never smoke while performing repairs, especially when handling refrigerant.**
- **Be careful the liquid refrigerant does not come in contact with the skin.**

If liquid refrigerant strikes eye or skin:

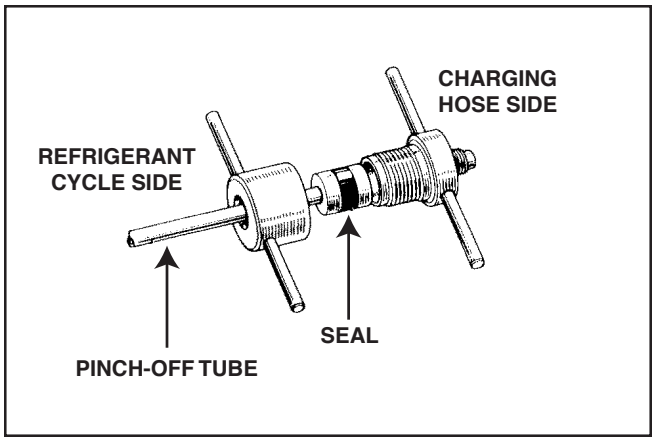
- **Do not rub the eye or the skin.**
- **Splash large quantities of cool water on the eye or the skin.**
- **Apply clean petroleum jelly to the skin.**
- **Go immediately to a physician or to a hospital for professional treatment.**



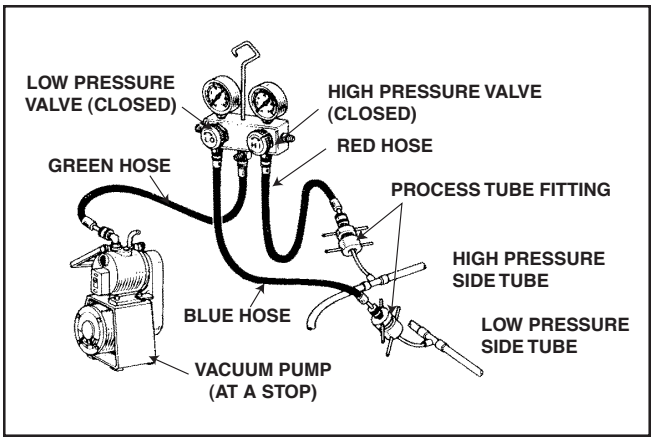
A. Connection of Gauge Manifold

(1) Properly remove the crushed end of the pinch-off tube at the high pressure side and the low pressure side of the refrigerant cycle with a pipe cutter.

(2) Fit the process tube fitting to the pinch-off tube on both sides.



Connection of Gauge Manifold

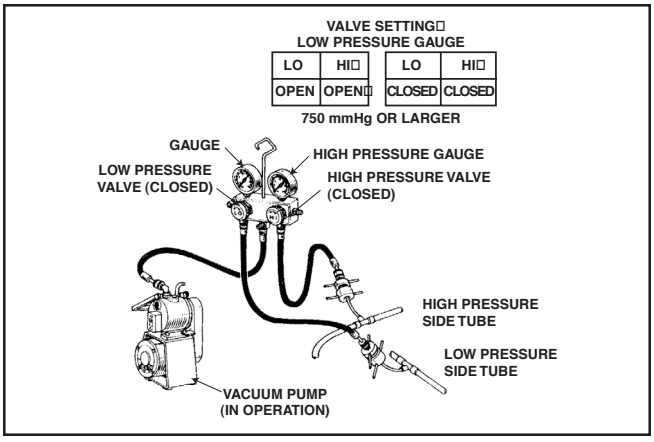


Hose Connection

NOTE: Connect the hoses using care not to mistake the high pressure side for the low pressure side and vice versa.

(3) Connect the charging hoses (red - high pressure side, blue - low pressure side) of the gauge manifold to the process tube fittings.

(4) Connect the charging hose (green) at the center of the gauge manifold to the vacuum pump.



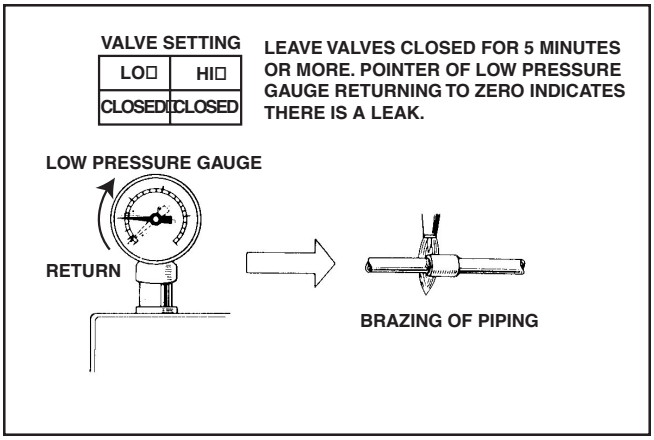
Evacuation

B. Evacuation

(1) Open the high pressure valve (HI) and the low pressure valve (LO) of the gauge manifold.

(2) Turn on the vacuum pump to start evacuation. (Evacuate the system for approximately 20 minutes.)

(3) When the low pressure gauge indicates 750mmHg (29.55 in.Hg) or larger, turn off the vacuum pump and close the high and low pressure valves of the gauge manifold.



Checking Vacuum

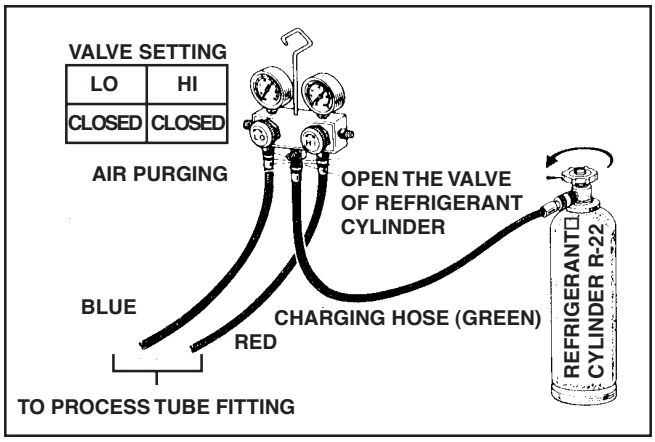
C. Checking Vacuum

(1) Leave the high pressure valve and the low pressure valve of the gauge manifold closed for five minutes or more, and confirm that the gauge pointer does not return to zero.

(2) If the gauge pointer returns gradually to zero there is a leak somewhere in the system (this could also include gauge manifold). Perform leak check according to procedure indicated in 28D. Once leak has been found and repaired evacuate the system once more, and confirm system holds vacuum.

D. Checking Gas Leak

(1) Remove the charging hose (green) from the vacuum pump, and connect the hose to the refrigerant cylinder (R-22).



Checking Gas leak

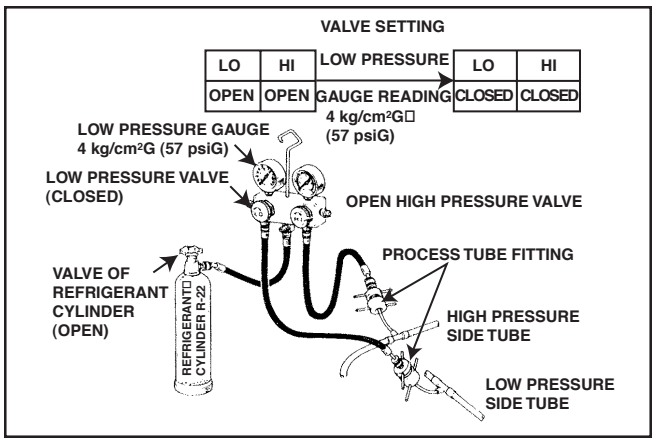
(2) Loosen the nut on the gauge manifold side of the charging hose (green).

(3) Open the high pressure valve of the gauge manifold. Charge the system with refrigerant until the low pressure gauge indicates *57 PSIG. (4 kg/cm²G.)* After charging is complete, close the high pressure valve.

(4) Check carefully for gas leaks inside the refrigerant system using the gas leak tester.

(5) Repair any leak.

⚠WARNING: Do not attempt any repair on a charged system.



Still Checking Gas Leak

⚠WARNING: Before checking for gas leaks, fully confirm that there is nothing flammable in the area to cause an explosion or fire. Contact of refrigerant with an open fire generates toxic gas.

E. Evacuation (Repeat)

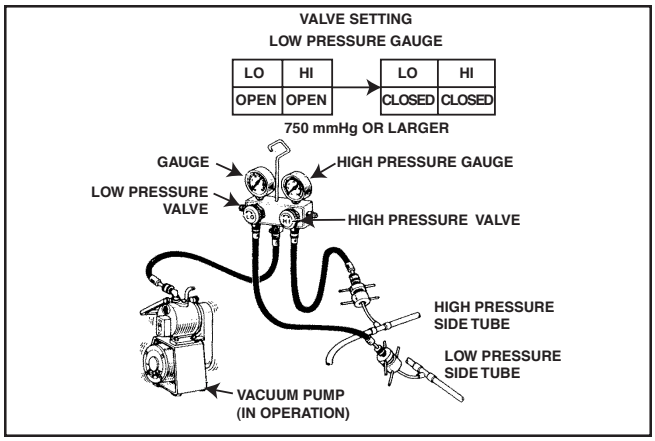
(1) Close the valve of the refrigerant cylinder. Then remove the charging hose (green) from the refrigerant cylinder, and connect it to the refrigerant recovery machine.

NOTE: Keep the high pressure valve and the low pressure valve of the gauge manifold closed.

(2) Using procedure 28B., evacuate the system until the low pressure gauge indicates *750mmHg (30in.HG) or greater.* (For 15 minutes or more.)

(3) After evacuation is complete, close the high and the low pressure valves of the gauge manifold.

⚠CAUTION: Be sure to evacuate the system twice or more using the repetitive vacuum method. Evacuate the system an additional time on rainy or humid days.



Evacuation

29. Refrigerant Charging Work

A. Refrigerant Charging

(1) Remove the charging hose (green) from the vacuum pump, and connect it to the refrigerant cylinder (R-22).

(2) Loosen the nut on the gauge manifold side of the charging hose (green). Open the valve of the charging hose (green). Open the valve of the refrigerant cylinder.

(3) Securely place the refrigerant cylinder on a scale with a weighing capacity of 70 lbs (30 kg) that is graduated by 0.2 oz (5 g).

(4) Open the high pressure valve of the gauge manifold and the valve of the refrigerant cylinder. Charge the system with refrigerant to the specified amount.

Standard Amount of Refrigerant:
1.61 lbs / .73 kg

If the system cannot be charged with the specified amount of refrigerant under this condition, follow the steps below:

(a) Close the high-pressure valve of manifold.

(b) Operate the refrigerant system.

(c) Slowly open the low-pressure valve while observing the scale reading.

(d) When the scale reads the specified amount, immediately close the low-pressure valve.

(e) Bring the system to a stop.

⚠CAUTION: The amount of refrigerant charged has a great effect on the cooling capacity of the unit. Charge to the specified amount, always observing the scale graduations while charging.

(5) Close the high pressure valve of the gauge manifold and the valve of the refrigerant cylinder.

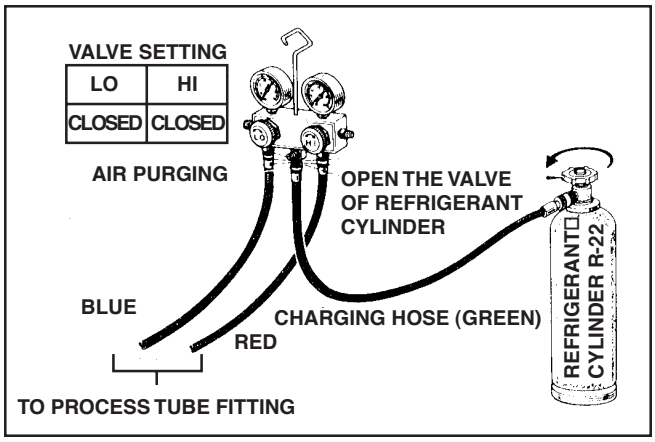
B. Removal of Gauge Manifold

(1) Crimp the pinch-off tube with a pinch-off tool.

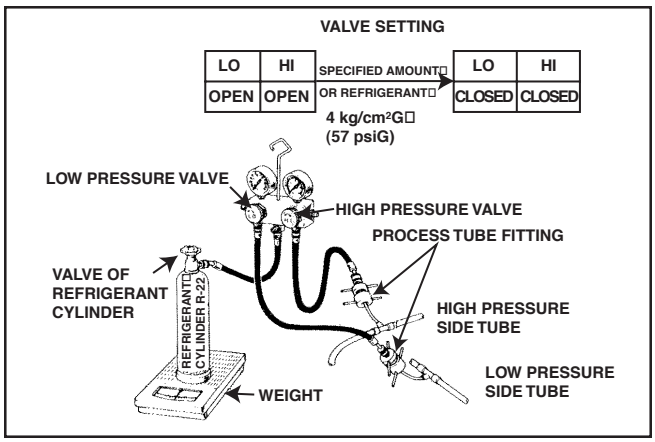
(2) Remove the gauge manifold and the process tube fitting. Crush the end of the pinch-off tube.

(3) Braze the end of the pinch-off tube.

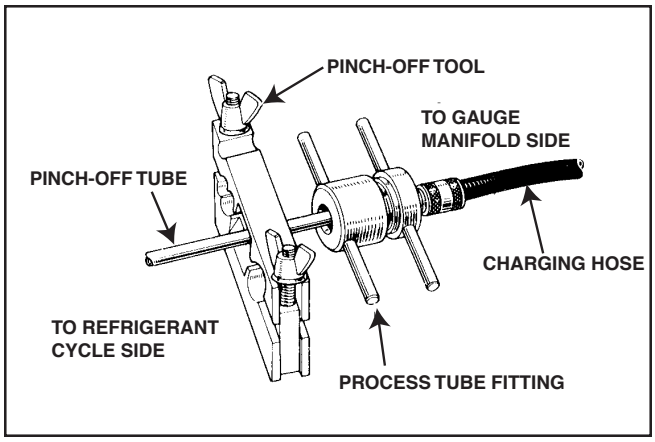
(4) Ensure that a gas leak is not present at the pinched off portion and the brazed end.



Refrigerant Charging Work



Refrigerant Charging Work



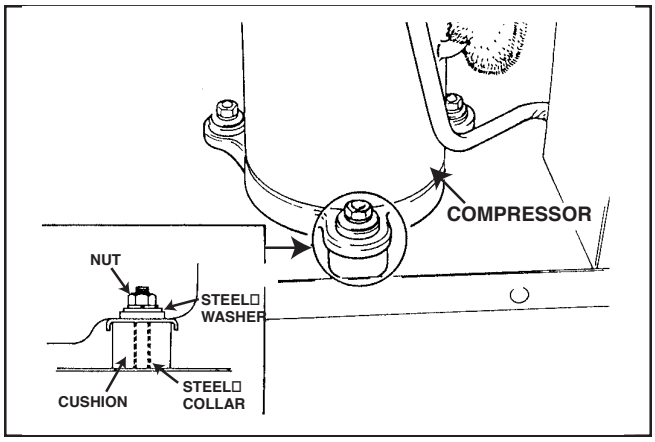
Removal of Gauge Manifold

TROUBLESHOOTING AND REPAIR

Reassemble the unit in the reverse order of removal. Described below are the parts that require special care in reassembling the unit. Perform all wiring or rewiring as referenced in the wiring diagram.

30. Compressor Mounting

Mount the compressor on the frame, using cushions, steel collars, steel washers and nuts.

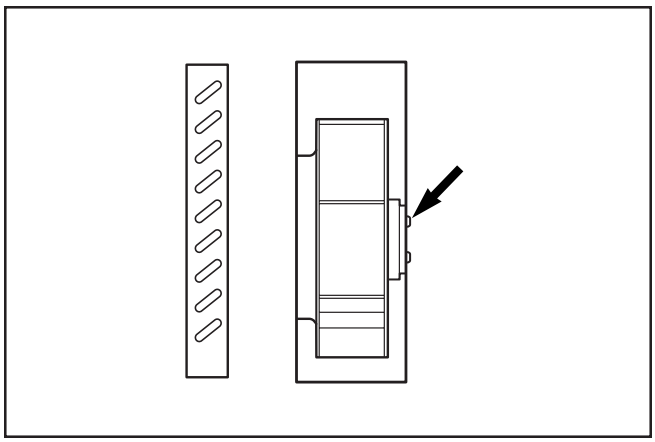


Compressor Mounting

31. Blower and Condenser Motor Assembly

a. Install blower fan (for evaporator) and condenser fan.

Tightening torque:
1.10 ± 0.22 lbf•ft (15.5 ± 3.0 kgf•cm)



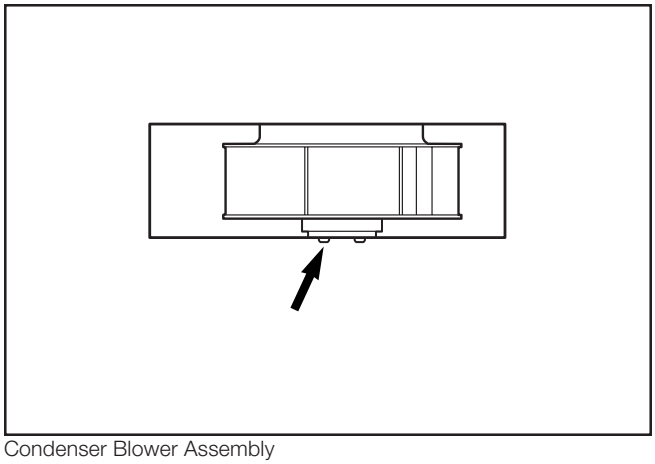
Evaporator Blower Assembly

32. Wiring Notice

Secure the wires using clamps so that they do not come into contact with the edges of the structure, etc. Secure the wires using clamps in the same position they were before removal.

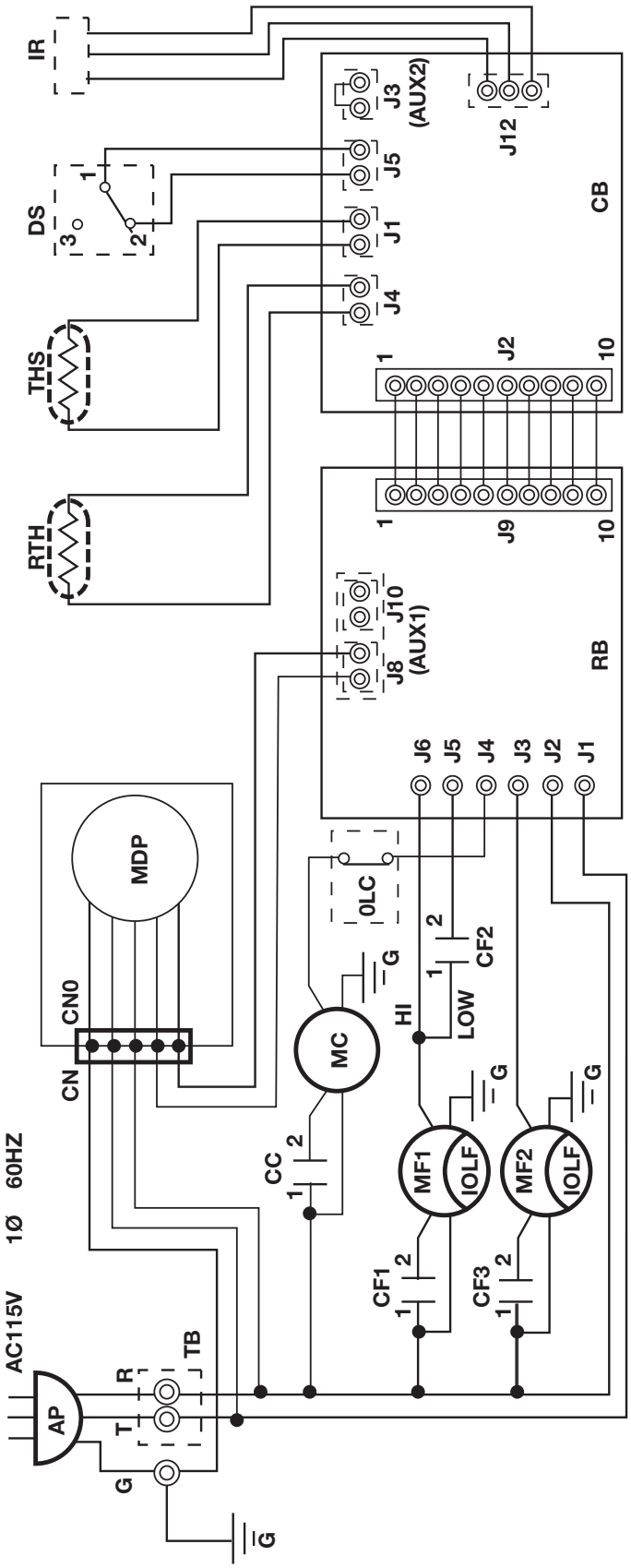
33. Perform the inspection of cooling capacity and check for abnormal noise or abnormal vibration.

NOTE: Casters should roll and swivel freely. Check for dirt or dust build up. Remove dust or dirt build up.



Condenser Blower Assembly

34. Schematic



AP	Attachment Plug	OLC	Overload Relay of Compressor
TB	Terminal Block	DS	Full Drain Warning Switch
CB	Control Board	THS	Freeze Protection Thermistor
RB	Relay Board	RTH	Room Thermistor
MF1	Fan Motor of Evaporator	IR	Remote Receiver Board
MF2	Fan Motor of Condenser	G	Ground
MC	Compressor Motor	CN	Connector for Drain Pump (Unit Side)
CF1	Capacitor for Fan Motor of MF1	CNO	Connector of Drain Pump (Pump Side)
CF2	Capacitor for Fan Motor of MF1	MDP	Drain Pump
CF3	Capacitor for Fan Motor of MF2		
CC	Capacitor for Compressor	AUX1	Auxiliary Connector
IOLF	Internal Overload Relay of Fan Motor	AUX2	Auxillary Connector / Jumper

Wiring Diagram

TROUBLESHOOTING AND REPAIR

DENSO

DENSO SALES CALIFORNIA, INC.

TECHNICAL SERVICE DEPARTMENT
First Issue: July 2003
DSCA P/N: LA990009-1196

Printed in U.S.A.

(800) 264-9573

www.movincool.com

DSCA P/N: LA990009-1196